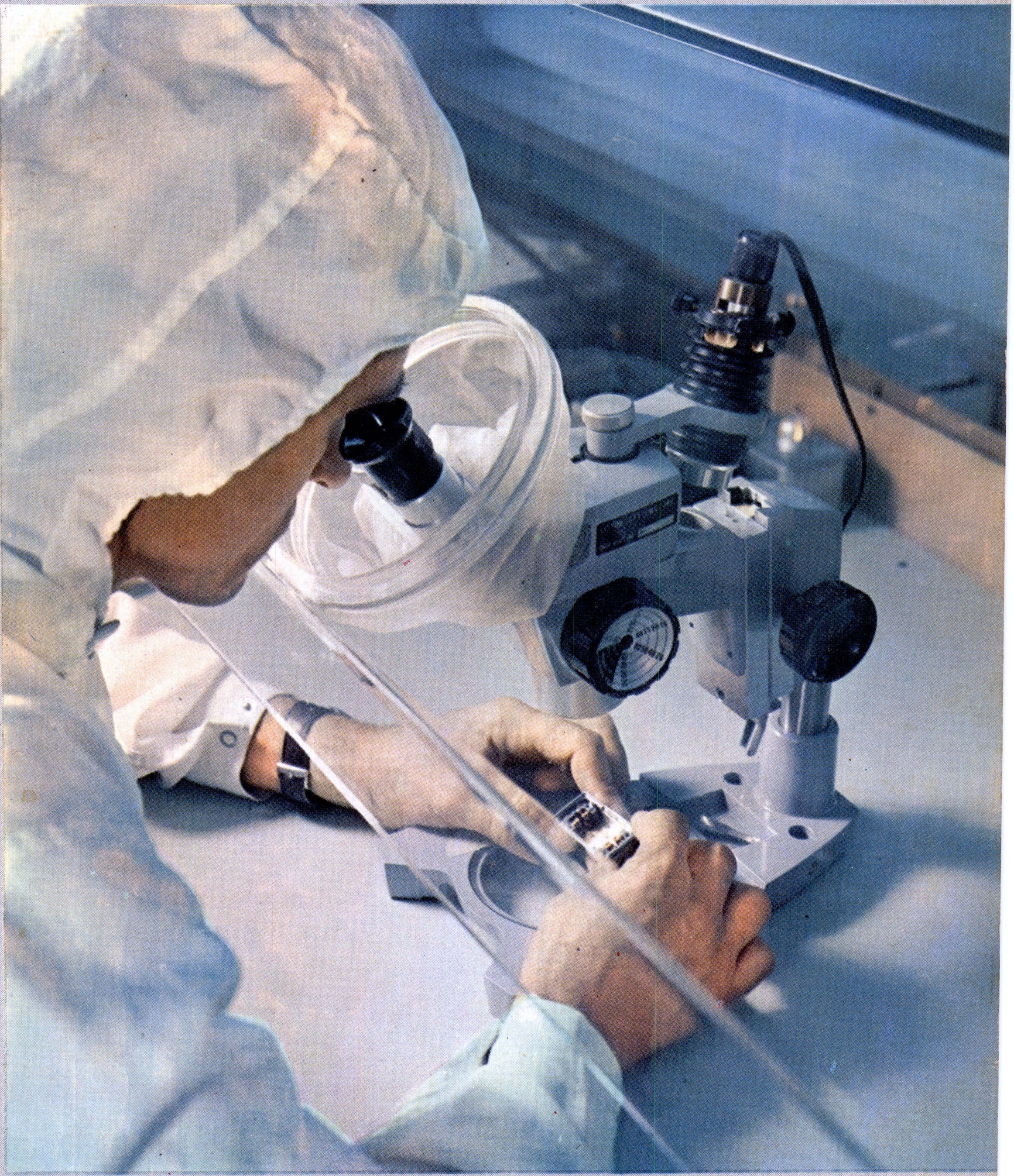
ELECTRONICS Australia

August, 1967

Incorporating RADIO, TELEVISION & HOBBIES

Vol. 29 No. 5



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ELECTRONICS Australia

Incorporating "RADIO, TELEVISION and HOBBIES"

ABC certified circulation in excess of 47,000.

Volume 29, No. 5

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Box 2728, G.P.O., Sydney, Australia.

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SELWYN SAYERS, Mgr.
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Offices: 8th Floor, 235-243 Jones Street, Broadway, Sydney, Australia. Phone 2-0944, Ext. 2931, 2508, 2943.
CLARRIE LEVY, Rep., Melbourne, 392 Little Collins Street. Phone 67-8131.

Circulation:
A. PARKER, Mgr.
Offices: 9th Floor, 235-243 Jones Street, Broadway, Sydney, Australia. Phone 2-0944, Ext. 2505, 2509.

Subscription Rates—See back page.

Representation:
Melbourne—John Fairfax & Sons Ltd., 392 Little Collins St. Phone 67-8131.
Brisbane—Sungravure Pty. Ltd., 78 Elizabeth Street. Phone 2-6688.
Adelaide — John Fairfax & Sons Ltd., 104 Currie Street. Phone 51-3502.
Perth—Sungravure Pty. Ltd., 847 Hay Street—Phone 23-4513.
Newcastle, N.S.W.—Associated Newspapers Ltd., 22 Bolton Street. Phone 2-3696.
London—John Fairfax & Sons (Aust.) Ltd., Reuter Building, 85 Fleet Street.
New York — "The Sydney Morning Herald" Ltd., "Times Annex," 229 West 43rd Street.

Distribution:
Distributed in N.S.W. by Sungravure Pty. Ltd., Jones St., Broadway, Sydney, N.S.W.; in Victoria by Sungravure Pty. Ltd., 392 Little Collins Street, Melbourne; in South Australia by Sungravure Pty. Ltd., 104 Currie Street, Adelaide; in Western Australia by Western Press; in Queensland by Gordon and Gotch (A'sia) Ltd.; in New Zealand by Truth (N.Z.) Ltd.; in Tasmania by Davies Bros. Ltd., "Mercury," Hobart.

Talking To Machines

Featured on television recently was a brief segment showing a computer responding to the spoken commands of its operator and, in turn, re-expressing information in its own synthesised version of a human voice. In a way, it was a primitive demonstration of that bizarre concept of a man talking with a machine.

Technically, the gulf between such a demonstration and the ultimate concept is vast. It does not follow, however, that it will ever need to be bridged in terms of ordinary, conversational speech.

To create a machine with the capacity to carry on a normal, human conversation would be a fantastic undertaking and, in large degree, an exercise in inefficiency. The fact is that normal conversation contains an enormous amount of wordage, superfluous to the basic purpose of exchanging information. A great deal of what we say has to do with social pleasantry—or unpleasantry—or is the result of an urge to fill an awkward silence. Even when we set out to convey information, our statements are loaded with superfluous words and ill-chosen phrases.

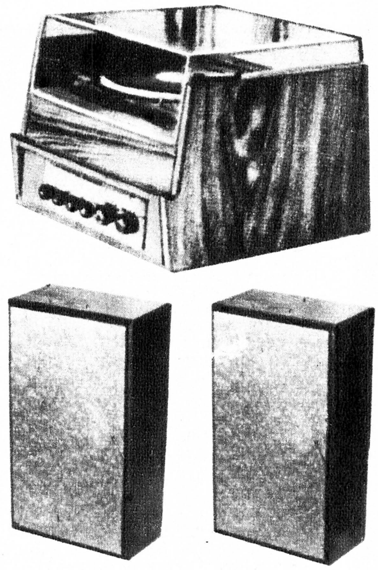
Just as writing compels an economy of expression and a more careful choice of words, so our involvement in computer technology must bring about a further rationalisation in the way we seek, express, store and recover information. Instead of aiming at machines which can cope with all idiosyncrasies of human conversation, we may well have to learn to express ourselves in the more factual and objective language of the machine.

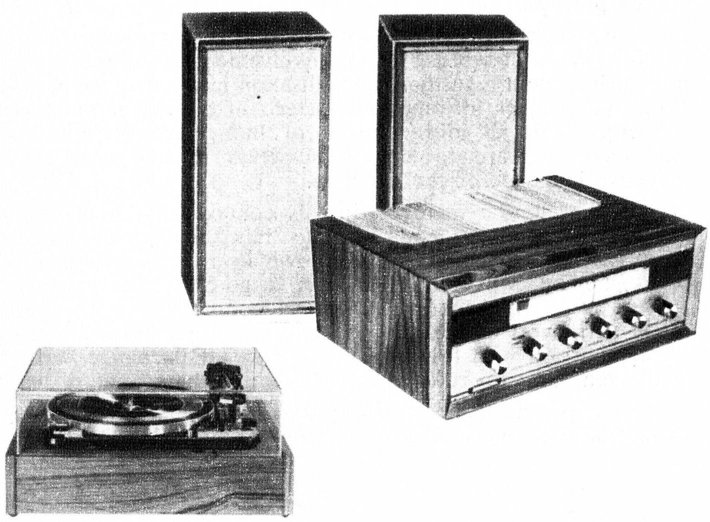
It is well to remember, in this context, that it is becoming an everyday occurrence for machines to "talk" between themselves. When there is a brief opening or breakdown in a data transmission circuit, one "machine" will instruct another to go ahead, or pause, or repeat for purposes of checking. A central computer can co-operate with many peripheral equipments to handle multiple tasks simultaneously. By comparison with this kind of information exchange, what happens at the computer/operator interface seems cumbersome in the extreme.

Perhaps the radio amateur has something when, instead of a formal farewell speech, he can simply tap out: "73's OM."

August, 1967

COVER PICTURE: Cleanliness is a strict necessity for the assembly and servicing of delicate sub-systems to do with the inertial guidance equipment being fitted to F-111 aircraft. This picture was taken at Litton Industries Guidance and Control Systems Division at Woodland Hill, California, U.S.A.





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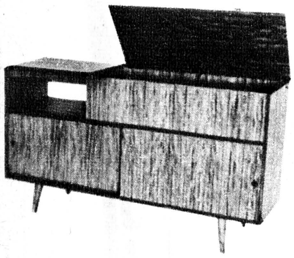

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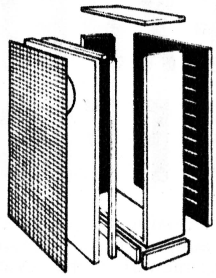

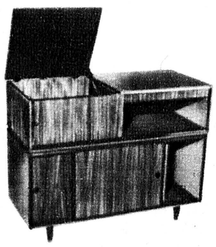

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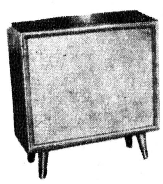

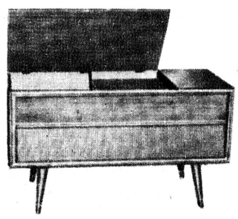

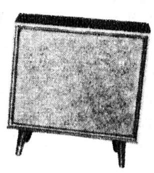

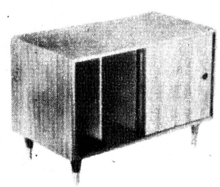

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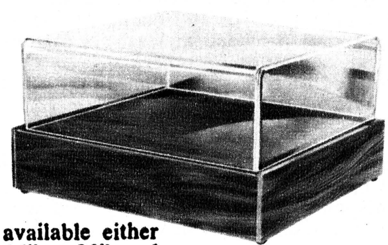

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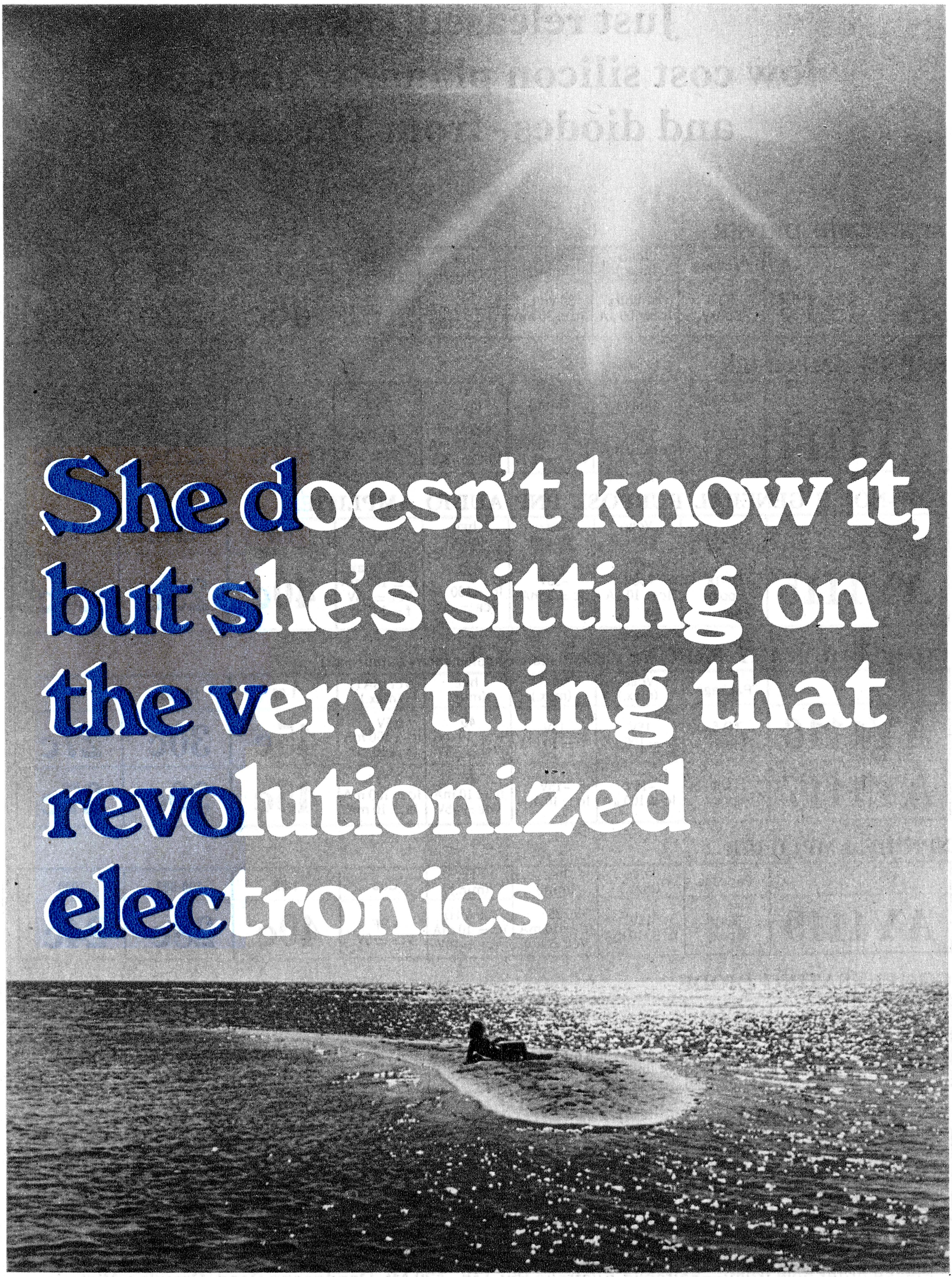
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AY1119	TO-18 Epoxy	15V $I_C = 10$ mA	35 $I_C = 10$ mA $V_{CE} = 1.0V$	400 MHz $I_C = 10$ mA $V_{CE} = 10V$	4 PF $V_{CB} = 5V$	**40c**	**28c**	**24c**

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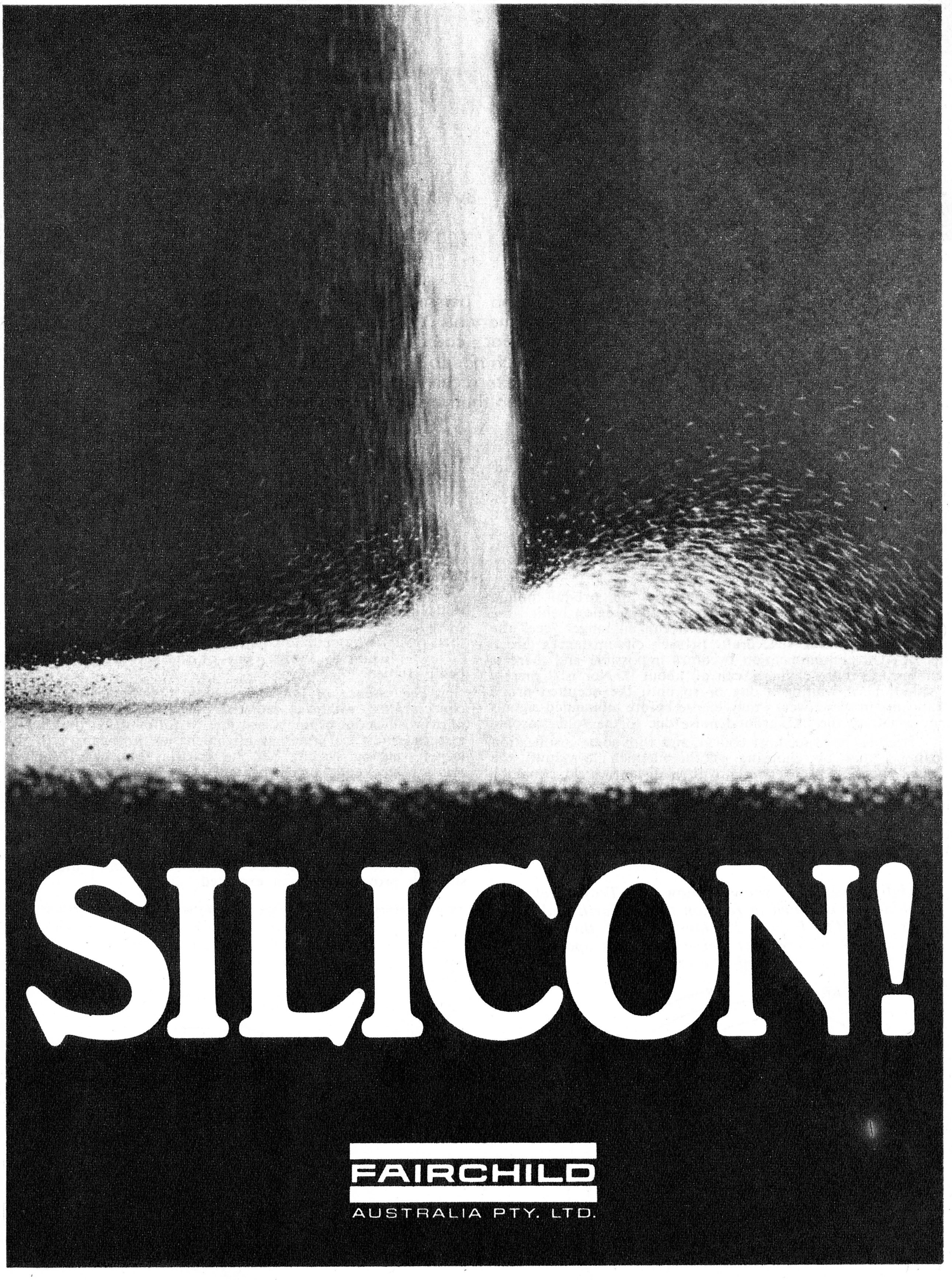

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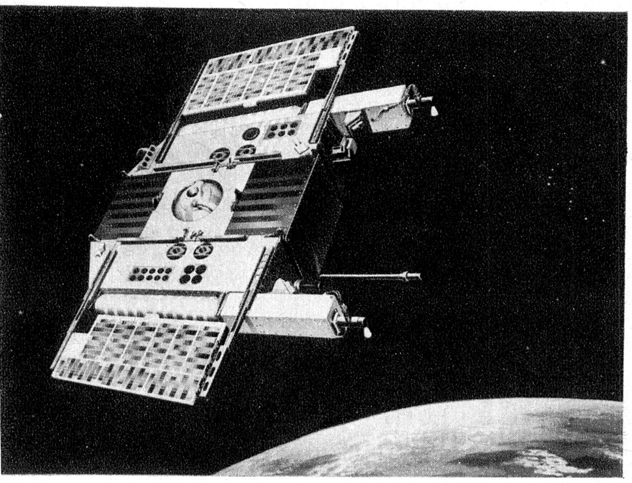


SPACE TROJANS—

By James Strong, B.Sc. (Eng.), A.C.G.I.

Artist's impression of a typical space probe, built by the Lockheed Missiles and Space Company for the U.S.A. Air Force.

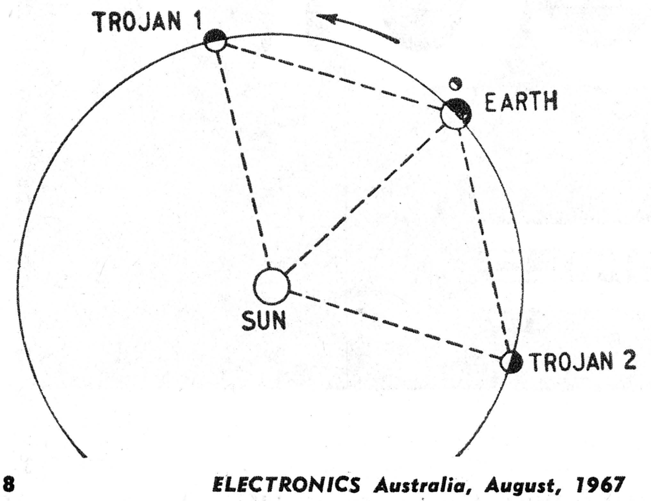
Radio "periscopes" which would remain permanently fixed in certain discrete locations in space could be the answer to a problem which has so far hindered space research — how to receive radio signals from space probes when their orbits carry them behind the sun.

If the currently debated proposal to survey the Solar System with the aid of interplanetary probes is shown to be feasible, some awkward problems in two-way radio communication will have to be faced. For although the successful Mariner flights to Mars and Venus might suggest that a straightforward improvement in radio range is all that is needed to cope with more distant probes, the problem is now seen to be more fundamental.

Primarily the difficulty stems from the orbital motion of the Earth, which each year bears it to a region behind the Sun, relative to any probe, where it can no longer "see" the radio aerials of the spacecraft. In such circumstances direct, line-of-sight communication becomes impossible and there is nothing the radio engineer can do about it. Nor is it merely a question of waiting a day or so until the occulted probe reappears in view; weeks may elapse before attenuated signals can penetrate the background noise due to the solar corona.

It could be argued, of course, and with some justification possibly, that by choosing another launch "window" the crucial moment of encounter with a distant world could be put off to a more convenient date. This may be true enough in some instances, but it is expediency pure and simple and, with the hope for expansion in future space activity, can we afford to accept a hiatus in communication every time the Earth finds itself in conjunction with a transmitting source?

LEFT: Figure 1, showing how the Trojan relays would be positioned in relation to the Earth and the Sun. RIGHT: Figure 2, showing how the relays would prevent contact being lost with spacecraft behind the Sun.

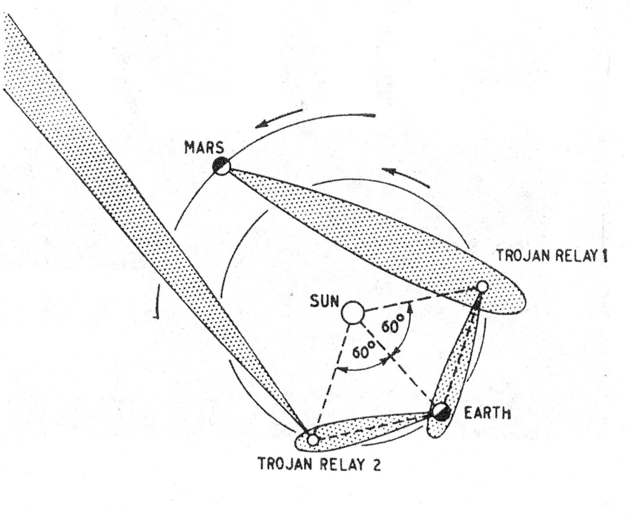


If planetary orbiters are to do their work efficiently, year in, year out; if solar probes are to travel within 0.1 astronomical unit* of the other side of the sun; if comets have to be intercepted anywhere in space at rapid notice, talk of convenient launch dates becomes meaningless. And with the possible establishment of manned bases on other worlds, including trip times of 400-500 days, continuous communication, with no reservations, becomes imperative.

However, before proposing a possible solution to the difficulty, it is worth studying the communication techniques used for each of the Mariner interplanetary flights. This will then reveal why similar methods cannot be applied to, say, a "flyby" mission to Jupiter, one of the survey projects now being studied.

The essence of long-range radio communication lies in concentrating whatever radiated power is available into as narrow an aerial beam as possible. It follows that the second essential must be precision alignment of the beam with the target tracking system, i.e. the Earth. Mariner II on its journey to Venus used an Earth sensor, a photomultiplier boresighted to its high gain aerial, which served to lock the aerial beam on to the Earth's disc. Even so, there was a risk that the sensor would mistakenly come to rest on the Moon when it searched initially, and provision was made for ground signals to override the spacecraft's internal circuits, causing it to break the lock and search again if the signal strength proved less than expected.

*One astronomical unit equals the mean distance of the Earth from the Sun.



Solar System Radio Relay Stations

In the case of the Mariner IV flight to Mars this method could not be adopted as the Earth moved in orbit inside Mariner IV's flight trajectory, and in trying to follow the Earth's disc the sensor would almost certainly be "blinded" by the Sun. Instead, and because the trajectory was opportune, it was found possible to fix the axis of the high gain aerial with respect to the flight path and still cover the Earth adequately within the aerial beam for most of the 228-day journey.

To bring the aerial to bear in the right direction, now it was fixed, quite an elaborate attitude control manoeuvre had first to be executed. Shortly after being launched on course, and having freed itself from its Agena boost stage, Mariner IV spread its solar panels, searched for the Sun and locked on to it. It could then draw power and dispense with its internal batteries. Because a second reference axis was also needed the spacecraft then slowly rolled about its solar-pointing axis until its star-tracker had acquired Canopus, a large-magnitude star conveniently close to the south ecliptic pole. Once these two reference axes were secured, mutually at right angles, the vehicle's attitude was fixed in space and its aerial system automatically pointed directly toward Earth. Apart from some concern early on, when the star-tracker repeatedly lost lock and came to rest on another star, the system performed with merit once the trouble had been identified and effectively isolated.

Turning now to the requirements for a probe surveillance of Jupiter, whose orbit lies beyond Mars, some 400 million miles away, neither of the two Mariner methods of aerial pointing are of any use. Calculations show that even when propelled by the powerful Saturn boosters soon to become available, an interplanetary probe will still take 2½ years to reach Jupiter. Consequently the Mariner IV fixed aerial principle would be unable to cope with a situation in which the Earth twice circled the Sun during the trip time, while Earth sensing is plainly confined to trajectories that lie inside the Earth's orbit where the sensor looks away from the Sun.

No doubt a steerable aerial, programmed to follow a year-long, simple harmonic sweep would fit the bill, provided enough fuel for the continuous operation of small thrust jets could be carried. Alternatively, the aerial could be locked on to the Sun, but we should then have to resign ourselves to communicating with the probe only when the Earth passed through the aerial beam. This is not as bad as it sounds, for contact would be made during the critical period up to four months after the launch date, when course corrections might be necessary. Thereafter contact would take place during the seventeenth and thirtieth months after launch, the latter period coinciding with an encounter with Jupiter.

During the somewhat prolonged intervals of silence between these dates, environmental data accumulated en route would have to be stored and played back when the opportunity presented itself. Either way, whichever scheme were adopted, all contact would still be lost when the Earth was in conjunction on the other side of the Sun. On the face of it there seems only one way to circumvent this dilemma, but it is a concept that calls for as much courage and imagination as it does careful thought.

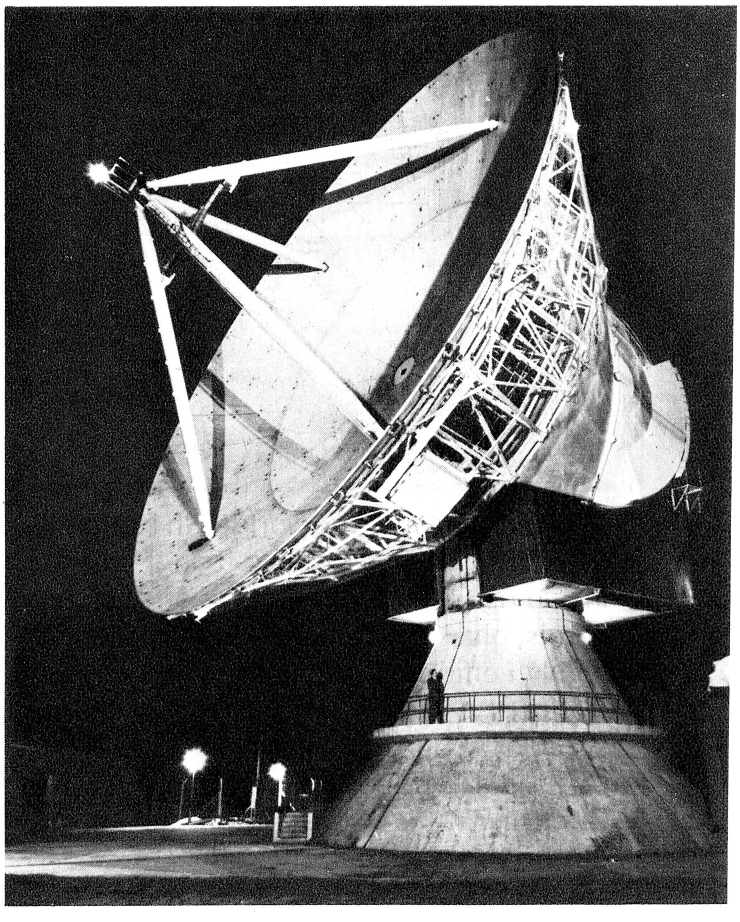
One of the lesser known theorems of celestial mechanics is the three-body problem, first published as an essay by the French mathematician, Lagrange, in 1772. In it he showed that if a planet, such as the Earth, revolved in a circular or elliptical orbit around a massive second body, such as the Sun, there were two positions in space where, if a third body were introduced, this body would remain in dynamic equilibrium. Both positions lie along the planet's orbital path, one leading and the other lagging behind the planet by 60 degrees respectively. They are known as "planet equilaterals" for they form, together with the sun and (in our case) the earth, the apices of two giant equilateral triangles whose sides are 93-million miles long (see figure 1).

The gravitational and centrifugal forces that hold an Earth equilateral body in space require, as a prime condition of equilibrium, that the body should be moving at the same speed and direction as the Earth and along its orbital path. With these conditions fulfilled, the body will then remain in its relative position indefinitely and only force can dislodge it.

Remarkable proof of the three-body problem has been found in the so-called Trojans of Jupiter, two groups of small asteroids (named after the heroes of the Trojan War —Hector, Achilles, Troilus, etc.) that are unmistakably travelling along Jupiter's path, ahead and behind the planet. Once wandering asteroids, they must have been captured in the remote past and are now prisoners for all time at Jupiter's equilaterals, perhaps better known as the Trojan Positions.

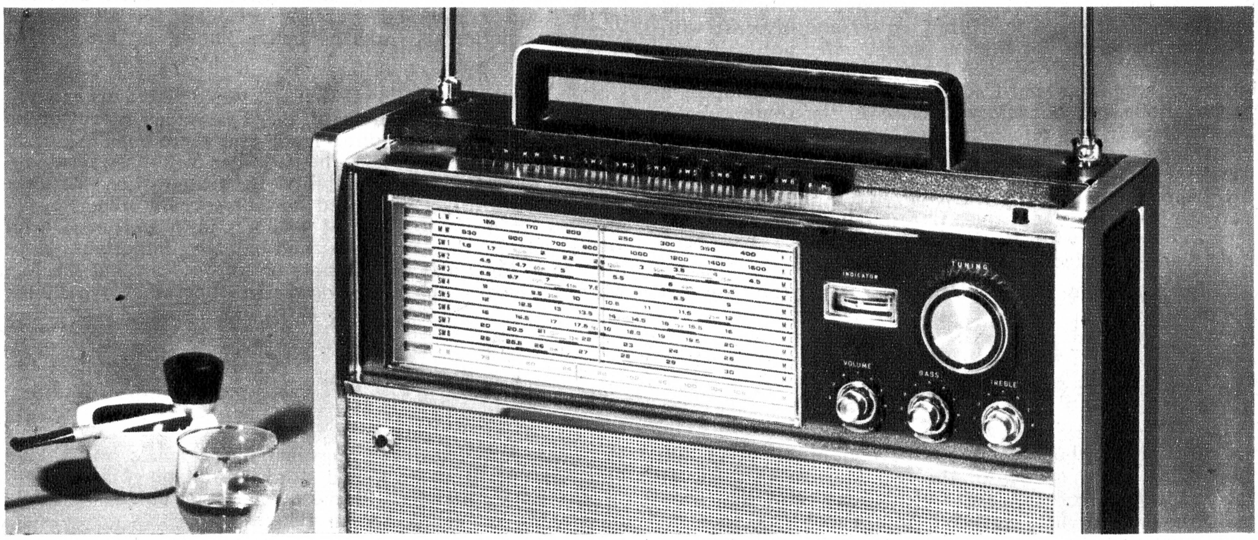
From this it follows that if we deliberately station satellites at the equilaterals of the Earth they also will be subject to the same natural laws, and there may be other benefits to be had. First, the satellites will possess an inherent, self-compensating ability to remain "on station," and we can forget the need to correct any tendency to drift, as we do in the case of satellites in synchronous orbit above the Earth. Secondly, and equally important, since they flank the Earth they enable us to "see" around the Sun where it blocks our radio view. In effect they would act as radio periscopes, relaying incoming signals we should otherwise never receive, and relaying outgoing instructions in the same manner. Because of their unique position, they could be called Trojan relays.

It might be asked whether the dynamic equilibrium of a Trojan relay would be disturbed by the gravitational pull of planets passing in adjacent orbits. Undoubtedly it would be perturbed to some extent, for every planet exerts some influence on every other body in the solar system, but with Venus never closer than 25 million miles, and Mars rarely less than 40 million miles away, their influence would



Britain's latest space aerial and radio telescope at Chilbolton, Cheshire, which was recently commissioned for the Radio and Space Research Station of the Science Research Council. Prime contractors were AEI Electronics.

NATIONAL RF-5000 RADIO



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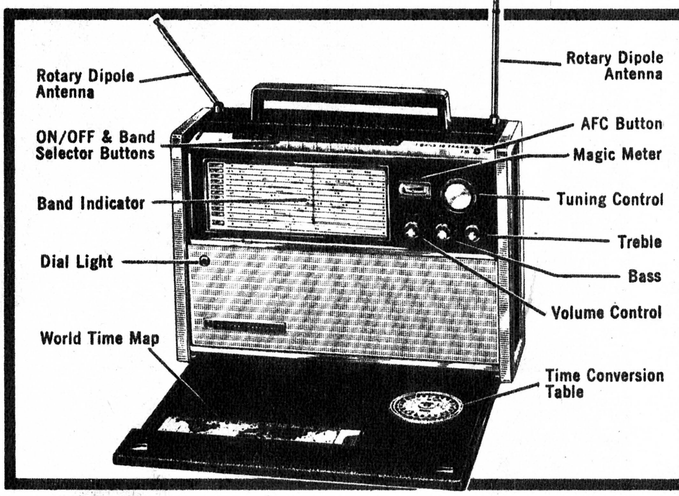

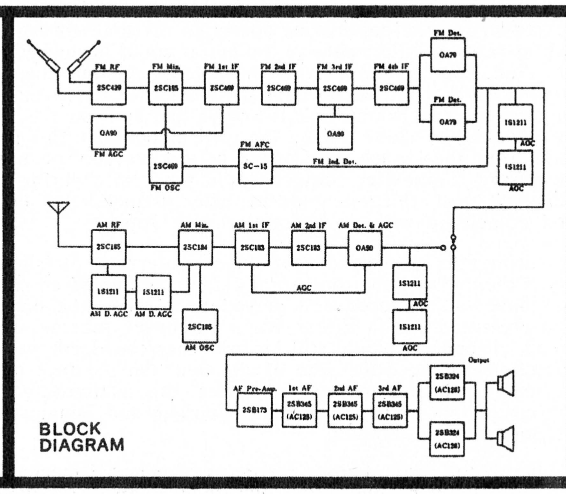

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be negligible. In these circumstances it is doubtful whether the orbital shift they might induce would be observable in much less than a century, and certainly there seems little need for qualms on this score.

Though Trojan relays will help to solve the difficulty of solar occulation, it is only fair to admit they are bound to bring other problems in their train. These may be grouped under the headings of reliability, attitude control, power supplies and long life. Placing the Trojans in position is the least of our worries, a matter of propulsive effort and navigational accuracy that is well within the capability of existing space equipment.

Until spaceflight becomes commonplace, and orbiting satellites are serviced periodically like Trinity House navigational buoys, a long and durable life, coupled with absolute reliability is essential. This would be especially pertinent to a Trojan relay for, at a distance from the Earth equal to the Sun itself, inspections would be most infrequent. It would probably be more economic to launch a replacement than go to the trouble of refurbishing one that has ceased to function for any reason. Consequently circuit redundancy, duplicate sub-systems, long-life power supplies and maximum protection from meteorite and radiation hazards must take priority in the design.

Ideally, of course, all electrical power should be drawn from the Sun, but it may be some while before solar cells are efficient enough to satisfy all needs completely. Meanwhile, contacting interplanetary probes launched in the next decade or so, with the prospect of reaching Saturn or even Uranus, 2,000 million miles from the Sun, will demand prodigious amounts of power. To meet this requirement large and improved nuclear-powered generators would have to be developed, even though their reliability in space is still an unknown quantity.

Attitude control, so vital to accurate aerial-pointing, will present the toughest problem of all, for any form of orientation by means of small thrust jets sets a limit on the life of the relay when the fuel is exhausted. The alternative seems to lie in the progressive development of gravity-gradient stabilisation, using the Sun's gravitational field to exert erecting forces on the relay via four long, slender booms at the end of which are fluid dampers. Initially the relay might have to be oriented by jets, but once a series of star-trackers had locked on to specific sources they could control the vehicle electrically, counteracting small oscillations by lengthening or shortening appropriate booms. Any forces or torques generated in the system as a result of swinging the aerial about an axis would naturally have to be balanced by moving counterweights.

Stabilising the relay by deliberately spinning it, as in the Intelsat satellites, is possible but perhaps not useful because of aerial-beam orientation problems. It is probably better to provide the relay with enough nitrogen fuel to stabilise itself with the aid of small gas jets. Without too great a weight penalty, enough fuel could be carried to last five years, and by then everyone will be anxious to replace the relay with something better anyway. Equipped with duplicate Canopus sensors, Earth sensors and Sun sensors, the relay should have no difficulty in orienting itself in space with sufficient accuracy to direct its aerials precisely when commanded to.

On the question of radio range it is now known that communication between such a relay station and earth is feasible. This can be seen from the fact that Mariner IV's 10-watt travelling-wave-tube transmitter supplied adequate signal strength over a distance of 134 million miles, and subsequently was detectable at 191 million miles, more than twice the distance from Earth to a Lagrangian "point" on the Earth's orbit.

However, it is conceivable that an interplanetry probe will have reached the vicinity of Uranus by the late 1980s and if a Trojan relay is in position and operational by then it will be expected to reach out to a distance of some 2,000 million miles. All things being equal, on applying the inverse-square law to the basic transmission formula it will be found that RF power of some 2-2½KW will have to be radiated. While future developments can perhaps be expected to reduce this figure, refinement of detail, as in other aspects of space flight, usually turns out to be less important than accepting the inevitable and learning how to generate copious amounts of energy.

Lastly, if so large and heavy a satellite is to be placed where it becomes the focal point for other, improved versions that may wish to occupy the same space one day, it must be possible to destroy the station completely so as not to constitute a hazard to its replacement. Admittedly space is large, and there is little risk of physical contact, but a few ounces of high explosive and a radio frequency combination lock will put an end to any chance interference or future embarrassment.

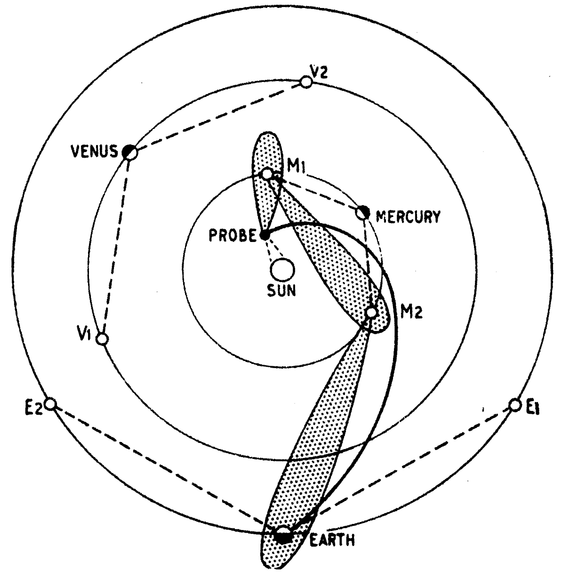


Figure 3. A network of Trojan relays stationed at the equilaterals of the inner planets Mercury and Venus would provide complete coverage for space activities inside the Earth's orbit. The diagram shows how data from a solar probe on the other side of the Sun would be relayed to Earth.

This leaves only the problem of launching and positioning the relays along the Earth's orbit. Perhaps contrary to expectation, both relays would be launched in a forward direction, relative to the Earth's motion, one swinging outwards along an arc that returned to intersect the orbital path, the other inwards to enter a perihelion orbit round the Sun before coming up behind the Earth. On reaching their stations, both relays would be slowed by retro-rockets to the same speed as the Earth. Their final position would not be important to within a degree or so, but the resultant velocity vector should be substantially correct.

The safe deployment of Trojan relays on either side of the Earth still leaves unresolved the question of how an interplanetry probe will recognise in which direction to aim its aerials. Circumstances will vary, and the only safe decision is to provide it with a steerable aerial and a set of reference axes. Direction co-ordinates would be transmitted from Earth when the time came, via a Trojan relay possibly, but now with sure knowledge that an answer should come back wherever Earth was (Figure 2).

Nevertheless, even with two Trojans operational, there still would be blind areas that could not be viewed, especially the region between the orbit of Mercury and the Sun. However, if Trojans can be set up at the Earth equilaterals they can be stationed just as easily at the equilaterals of the inner planets, Venus and Mercury. Being closer to the Sun, they would orbit more rapidly: Venus equilateral in 225 days and Mercury equilateral in 88 days. One or other of the six Trojans then in motion should ensure that solar system coverage was complete (Figure 3).

No doubt many aspects of this Trojan relay scheme are debatable and some people may well regard the whole idea as outrageous. But, equally, there may be other unsuspected advantages in the scheme that only the future can disclose. Possibly not until these have been realised will someone have the courage to propose putting the Trojans to work. ■

(This article was originally published in "Wireless World," March, 1967 issue, and is reproduced by arrangement with the U.K. Central Office of Information.)

PROBING THE SECRETS OF THE SOUTHERN SKIES

Astronomers all over the world are excited by the news that Australia is to have a giant 150in astronomical reflector telescope, the first of any significant size in the Southern Hemisphere. The availability of this instrument to study the constellations and galaxies visible in the southern skies is likely to have interesting developments.

by Patrick Moore, Director of the Armagh Planetarium

The news that a large reflecting telescope is to be set up in Australia is welcome for many reasons. It will be able to tackle various problems which have not yet been properly studied, and it will, of course, mean that the Commonwealth will continue to play a leading role in the ever-widening science of astronomy.

Astronomical telescopes were used in Britain at a very early stage. It is usually said that the first telescope in history was built by a Dutch optical worker, Hans Lippershey, about 1608, and that the first telescopic astronomer was the Italian scientist Galileo about a year later. Yet there is strong evidence that Thomas Harriott was using an astronomical telescope in Britain well before Galileo—and Harriott's map of the moon was certainly completed before the end of 1609. These early telescopes were feeble by our standards, and were not nearly so good as powerful modern binoculars. Even so, they caused a complete revolution in astronomy.

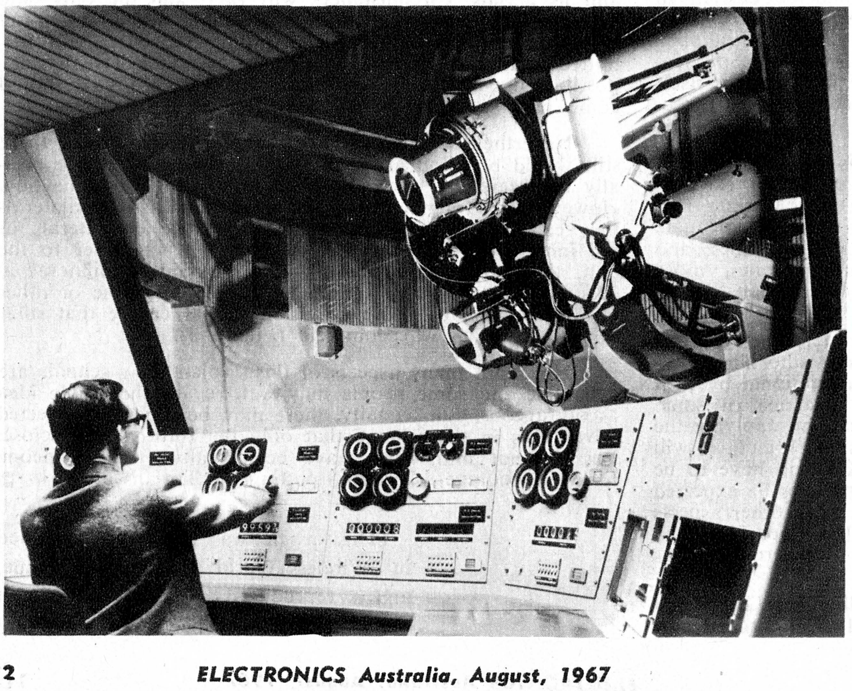
Galileo's telescope was a refractor—that is to say, it collected its light by means of a glass lens known as an object-glass. Unfortunately, it and subsequent refractors suffered from the defect that they produced false colour round any bright object such as a star. When the great Sir Isaac Newton investigated the nature of light, in 1666, he came to the conclusion that no cure for this trouble could be found, and so he developed an entirely new principle—that of the reflector, in which the light from the object to be studied is collected not by a lens, but by a mirror.

With reflectors, the false colour nuisance dose not arise, and Newton's first reflector, completed about 1671, was a great success. Its mirror was only one inch in diameter, but the principle of the instrument is still valid today. Incidentally, Newton was not the first to suggest the reflector idea; this is to the credit of a Scot, James Gregory. Ironically enough, Newton was making one of his rare mistakes when he abandoned the idea of a large refracting telescope. Later, an English amateur, Chester More Hall, found a partial cure by making a compound object-glass. The achromatic refractor, as it is termed, was developed by John Dollond, and for many years British telescope-makers were in a class of their own. On the other hand, the British climate is not really favourable for astronomical work; there is too much cloud and rain. Gradually, equipment in Britain was surpassed by the great telescopes erected in the U.S.A.

Nowadays, the main emphasis is upon reflectors. It is easier to make a large mirror than a large lens, and in astronomy it is size which matters most. In 1917 a new reflector, with a 100-inch mirror, was set up at Mount Wilson in California, and this was followed in 1948 by the 200-inch Palomar reflector. This telescope is named in honour of George Ellery Hale, whose skill and enthusiasm was largely responsible for its construction. Hale, a leading American astronomer, was also responsible for the Mount Wilson 100-inch, as well as various other giant instruments. He persuaded friendly American millionaires to finance the projects; but one must add, regretfully, that astronomically minded millionaires are not nearly so common nowadays as they used to be!

It is wrong to suppose that the modern astronomer spends much time in looking through his telescopes. Generally speaking, almost all the work is carried out by means of photography, so that the telescopes are used together with special cameras, and every hour spent in taking photographs means hours of desk-work analysing the results. Also, the main attention is upon the distant stars and star-systems. It is not often that a large telescope is turned toward our near neighbours in space, the moon and planets.

The sun is an ordinary star, and is merely one of a hundred thousand



Automatic control by simple dial setting has replaced lengthy manual operation on the new automatic twin 16-inch telescope at the Royal Observatory, Edinburgh, Scotland, which represents an important advance in the automation of telescopes. Automation permits the telescope to be operated by a single person with all measurements recorded directly onto computer tape.

million suns in our star system or galaxy. All these stars are immensely remote, and their distances are measured in light-years. A light-year is the distance covered by a ray of light in one year: almost six million million miles. Even the nearest star (not counting the sun, of course) lies at over four light-years from us. No telescope yet built will show a star as anything but a dot of light; a dot which must be analysed with the aid of complex auxilliary equipment.

During the 1920s, it was found that certain misty-looking patches in the night sky, known as spiral nebulae, were in fact separate star systems, or galaxies. This discovery was made by detailed studies of some of the unusual stars contained in them, and would not have been possible without the help of the Mount Wilson 100-inch reflector, which was then the most powerful telescope in the world. It became clear that these galaxies were millions of light-years away, and with the arrival in 1948 of the Palomar telescope the limits of the observable universe were pushed out to over 5,000 million light-years. The light now being received from these remote galaxies started upon its journey before the earth came into existence as a separate body.

There have been all sorts of by-products of this research. For example, in 1963 it was found that certain innocent-looking objects, which had always been taken for ordinary stars, are immensely remote and powerful. They are known as quasars, and it seems that a single quasar may shine as brilliantly as 200 complete galaxies put together. The problem is to understand how a relatively small object can produce so staggering an amount of energy, and once again we have to confess our ignorance. Quasars are thought to be at distances of thousands of millions of light-years and, like the remote galaxies, they are racing from us at thousands of miles per second. If modern ideas are right, then the whole universe is expanding.

If we are to make any serious attempt to solve problems of this kind, it is essential to study the very distant, dim-looking galaxies and quasars. Even the Palomar reflector, with its 200-inch mirror, cannot collect enough light to satisfy astronomers. To build a larger telescope would be a very difficult matter; but, oddly enough, the main need at the moment is for more reflectors of the 100-inch to 200-inch class. Observing time on the few existing telescopes of this size is very much at a premium, and in fact there are simply not enough giant telescopes to cope with the amount of research to be done.

This alone would make the Australian 150-inch reflector an important addition, but there is another point to be borne in mind also. Up to now the largest telescopes have been set up in the northern hemisphere of the earth and so cannot be used to observe objects which lie near the south pole of the sky. The Southern Cross can never be seen from Europe or the U.S.A. Neither can the two Clouds of Magellan, which look like luminous patches, but which we know to be the nearest of the important outer galaxies.

It so happens that the Clouds of Magellan are of vital interest. They are about 180,000 light-years away, so that we are seeing them as they used to be 180,000 years ago; yet they are much closer than the other large galaxies, and they contain objects of all sorts. For instance, the large cloud contains one "celestial searchlight," which is a star one million times as luminous as the sun, even though it is so remote that it cannot be seen without a telescope. There are gas clouds, clusters of stars, exploding stars and many other features, all spread out for our inspection. Studying the clouds can tell us much more about our own galaxy and the other systems.

Up to now, the clouds have not been surveyed in as much detail as is needed, simply because they cannot be seen with the world's largest telescopes. The 150-inch Australian reflector will put a very different complexion upon matters. In size, and hence in light-grasp, it will be inferior only to the Palomar telescope, and in the southern hemisphere it will be supreme. Astronomers all over the world await its completion with undisguised eagerness.

Theories can be drawn up and discussed, but no theory is of the slightest use unless it is backed up by observed facts. To gather these facts is the main task of the new Australian giant.

Chasing the Sun

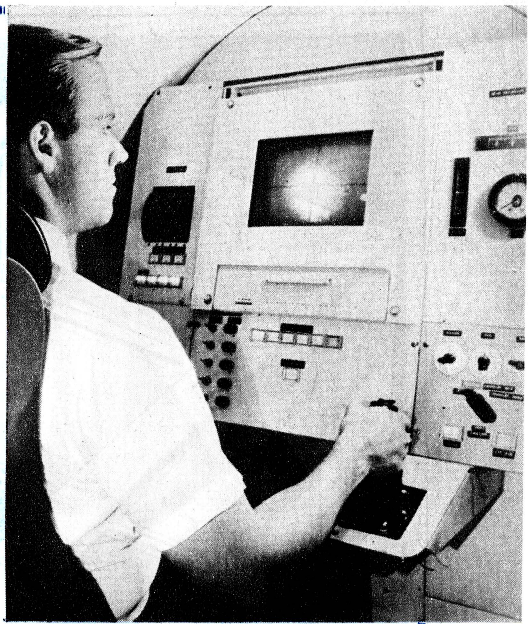
Men on the earth can now experience the same problems astronauts will face in space when they aim orbiting telescopes at specific spots on the earth, sun, or at pinpoint light sources in deep space.

The Lockheed Missiles and Space Co. has announced the completion of a system that simulates telescope aiming tasks astronauts will be called on to perform on space missions of the future. NASA is currently studying several programs which would involve orbiting telescopes, including Apollo Applications Programs in which the Apollo Telescope Mount (A.T.M.) will investigate solar phenomena. The Lockheed simulation device is a computer-driven astronaut control station with a television display system which shows where and how well the telescopes, or cameras in the case of the A.T.M., are aimed at various celestial bodies, sun spots, or other solar activity.

In simulating the A.T.M. aiming, a man in the control station moves the controls, and a computer adjusts the sun's image on the display screen to show how the A.T.M. would react in space to those control movements.

Dr Robert L. Martindale, who supervised construction of the system, explained that many points will be considered in building real aiming systems, including the necessity for astronauts to point telescope and camera mounts quickly and accurately. "Because of the importance of future astronomical experiments in space," he said, "and particularly those up-coming with the A.T.M., we must thoroughly understand the workings of man and equipment long before we go into space." He said that the Lockheed-developed device could simulate the dynamics of hardware like the A.T.M. and that numerous possibilities in aiming such hardware could be studied by programming control variations into the simulator's computer.

"One variation we'll study," said Dr Martindale, "is coupling, where a control adjustment in one axis causes movement in one of the other axes. For instance, you might adjust the roll of the A.T.M. and that might cause a change in the pitch. We must study the ability of man to control these movements to get the fine aiming necessary for the experiments."



Reacting to the slightest movement of this "space cabin's" controls, a computer adjusts the sun's image on the screen to show how a telescope mount would react in space to similar control.

He added that other variations to be studied would be slewing rates, or how fast telescope mounts would move during an adjustment, and the lag times in the control system, or the time that passed between the astronaut's moving of the controls and the hardware responding to those controls.

"To study A.T.M. aiming, a man in the control station of our simulator will be able to 'monitor' on his display screen the scenes that all of the cameras are photographing in the sun. This is possible because the A.T.M. film cameras will each have a television camera mounted alongside with a lens of the same focal length. By using the TV camera, the astronaut can 'monitor' the scenes being photographed by the film cameras.

"Since the simulator will let him switch from camera to camera, zoom lenses for closer shots, and make fine aiming adjustments, we should develop excellent data for timing research with orbiting telescopes. More important, we can use the data to evaluate methods of aiming control wih respect to man's ability to do the job."

PULSE CODE MODULATION

will modernise Britain's telephone network

In eight areas throughout Britain, 350 pulse code modulation systems are being incorporated into the telephone network by the Post Office. This is the initial stage of a widespread scheme expected to cost $A15 million.

The Marconi Company is to supply a large part of the equipment for the first stage, for which the Post Office has already placed contracts worth $A6.25-million. Marconi's will supply the equipment for three regions, including London.

Pulse code modulation (PCM) is new to telephone transmission systems and greatly increases the capacity of existing inter-exchange circuits.

In the 24-channel multiplex PCM system adopted by the G.P.O., analogue signals from a telephone receiver are sampled about 8,000 times per second, over twice the rate of the highest audio frequencies at which telephones operate. Each time, the polarity and the magnitude of the audio signals are measured and coded digitally. The polarity of the wave is represented by one digit (indicating positive or negative) and the amplitude by an additional six digits, allowing 2^6 (64) different values to be identified. A further pulse is used for synchronising and signalling purposes making a complete eight-digit signal composed of bi-polar pulses. This is a binary system using alternate positive and negative pulses (1 and —1) to replace the '1' digit of a conventional 1,0 binary code. It allows the equipment to operate within a more limited frequency spectrum, resulting in simplified equipment, particularly the repeaters.

The eight digit code takes a few millionths of a second to send, and before the next sample is taken, 8 digit codes from 23 other speech channels can be sent along the same telephone circuit. At the other end, a similar terminal installation separates all these telephone signals and reproduces each in the original form.

Sorting out the signals is achieved by the synchronising system which is entirely automatic. The signalling system ensures that when a subscriber hangs up, and the line becomes clear, the equipment will allow the normal telephone clearing and dialling signals to be sent along the line.

Owing to the very high pulse repetition rate at which the system operates, it is necessary to design the equipment to accept signals with a bandwidth of hundreds of times that of an ordinary audio speech signal. Due to this and the fact that the digital-analogue conversion techniques are relatively complex the equipment is itself complicated. However, the advantages gained from PCM far outweigh this consideration and make it superior to any other form of multiplexing on normal telephone cables. The same coding and decoding equipment is used for all 24 channels and, as a result, the cost of terminal equipment is considerably less than with other methods of channel multiplication. For example, Frequency Division Multiplex (FDM) has individual modulators and demodulators and expensive filters for each channel.

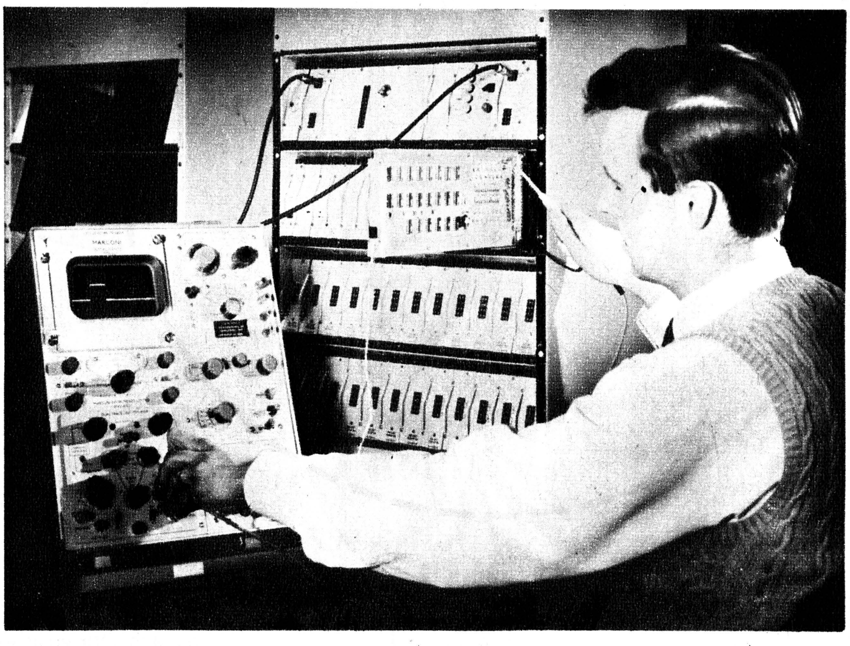
PCM signals are regenerated by repeaters at 2000yd intervals with relatively simple devices. All other multiplex systems so far devised require more complex regeneration methods.

The Marconi Series U1310 to be supplied to the U.K. Post Office achieves exceptional compactness and reliability through the extensive use of microcircuits. In a typical installation, equipment capable of coping with the demand from trunk circuits from several other exchanges can be accommodated in about six to ten equipment racks, about nine feet tall. The flexibility of this type of construction permits a number of different layouts, depending on customer's requirements. In addition, less floor space is taken up and yet very efficient air cooling is obtained.

Comprehensive alarm facilities are provided, such that in the event of loss of synchronisation, too high an error rate, failures in trasmission, or power failure, an alarm sounds and simultaneously the system ceases to send further signals. In addition, it can be arranged that the alarm is given in the event of other faults which do not necessarily mean closure of the system.

The number of times such an alarm system would be operated is minimised by the equipment's inherent reliabilty. In addition, routine testing is provided for checking the line repeaters and this equipment can be operated from the exchange. A special test signal is sent along the line and an audio note is returned from each repeater, the frequency of which depends on the specific repeater which is being monitored. The frequency is governed by a special bandpass filter which is installed at each repeater point solely for test purposes. The absence of the appropriate audio note from one of these filters gives immediate identification of faulty equipment, contrasting with other testing methods which might involve a special journey to open up manholes and make on-the-spot checks.

The Marconi Company is working on further applications of digital techniques to the telephone systems. Current development is directed to putting more than 24 channels over one circuit and the extension of PCM to long distance circuits. The company says it expects to make a significant contribution to the improvements to the U.K.'s telephone system now being brought about by the increasing application of electronics, of which PCM and the new electronic telephone exchanges are examples.



A PCM unit destined for one of Britain's telephone exchanges under test in the Marconi factory at Chelmsford, U.K. The module the engineer is testing is a timing card.

NEW

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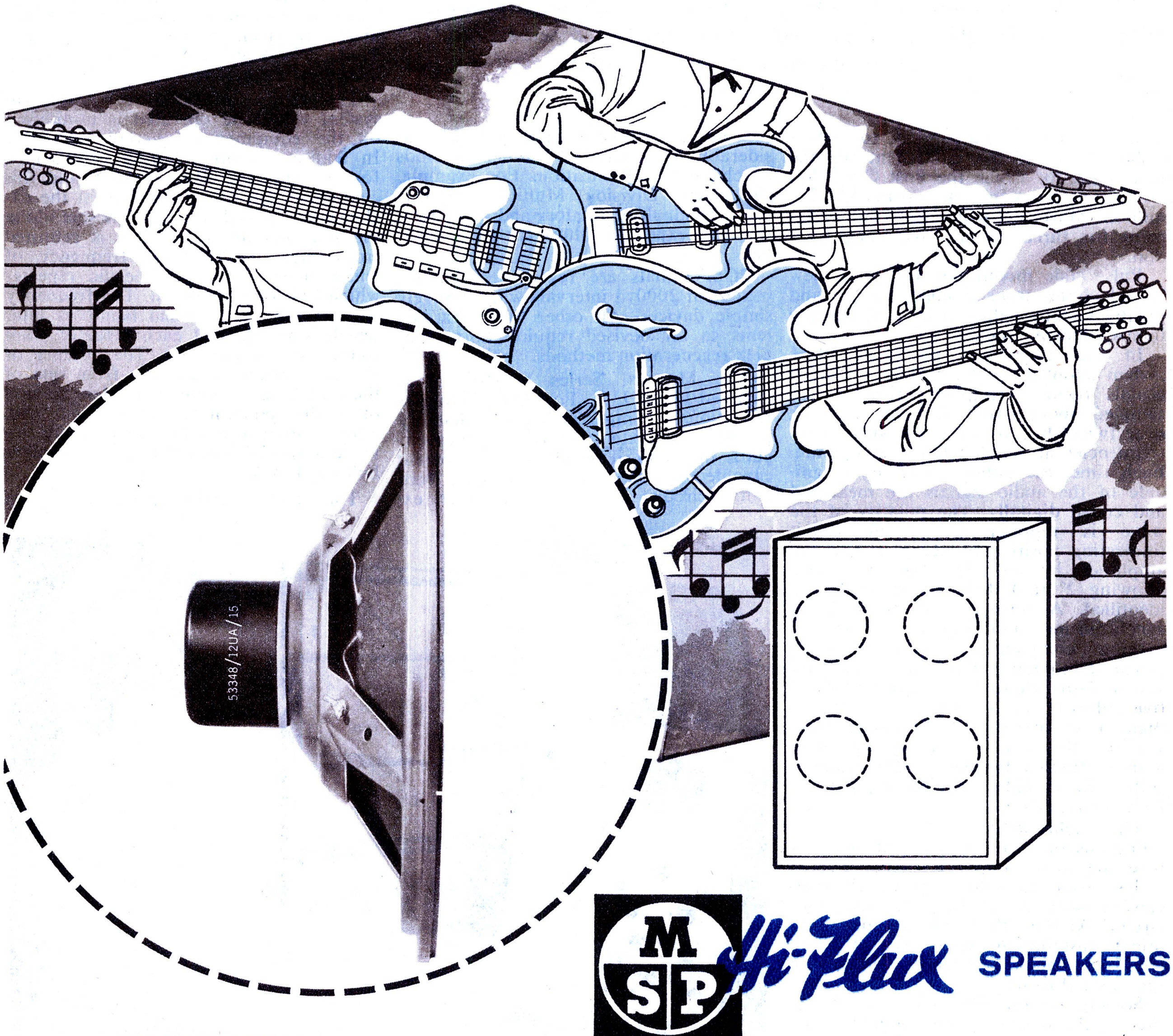

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Resonance	50 Hz
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Total Flux	100,000 lines
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Impedence	15 ohms
Mounting Hole Centres	11¾″ P.C.D.
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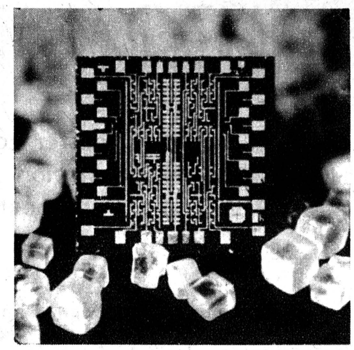
Computer Makes Masks for Integrated Circuits

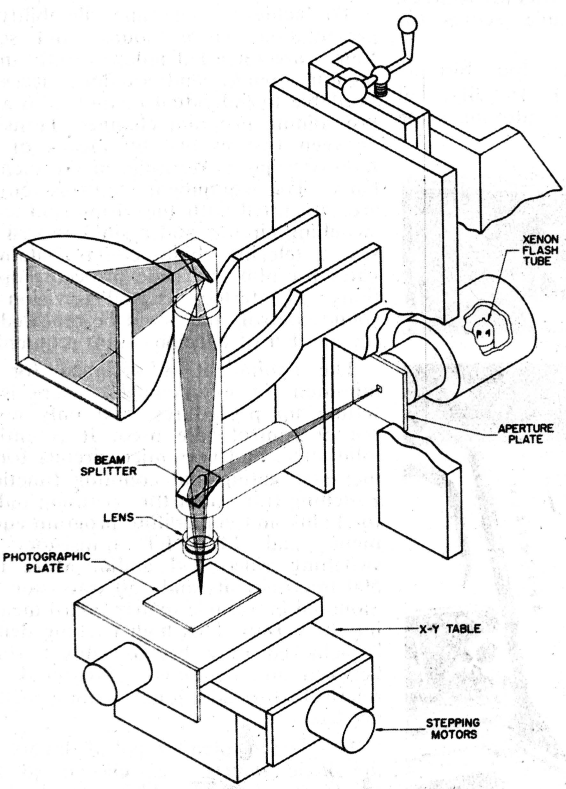


An integrated circuit chip of 55 NOR circuits made using masks generated automatically, shown with salt grains for size comparison.

Research workers of International Business Machines Corporation have overcome a major difficulty in making complex arrangements of integrated circuits. They have largely automated the design and fabrication of the circuit masks, cutting the time of these operations by more than a factor of ten.

In the process, most of the usual manual steps in design and fabrication of the circuit masks have been eliminated. The system has been used to generate sets of masks for complex integrated circuit chips containing over 100 NOR circuits. The time required to generate circuit masks of this complexity has been reduced to a matter of hours instead of hundreds of hours as formerly. The NOR Circuitry was implemented with insulated-gate field-effect transistors, but the mask generating technique has been applied to bipolar integrated circuits as well.

Traditionally, circuit masks are made by a laborious and time-consuming manual process. First an exact scale drawing (200 or 500 times final size) is made from a rough sketch of the circuit layout. Then the drawing is separated into a set of overlays — one for each processing step, such as metallisation, diffusion and contact holes. Each overlay pattern is cut on an opaque material with a transparent backing. After stripping the opaque layer from the pattern areas, the overlays are reduced photographically to 10 times final size, ready for the step-and-repeat camera.



A diagram of the light table used to draw the mask patterns at 10 to 20 times final size on high-resolution photographic plates. The movements of the X-ray table and the flashing of the lamp are both controlled by commands prepared by computer.

In the new process, the design and fabrication of masks consists of five basic steps. First the designer draws a rough pencil sketch of the circuit layout. Then he translates this into digital form by describing the circuitry in a symbolic notation — a specially developed high-level language for the mask designer. In step three, this symbolic language is fed to a computer and processed. In processing, the circuit structures are automatically assigned to their appropriate masks. The computer then generates a set of commands which can be used to drive a "light table" to draw the patterns for each layer of the mask set.

In the fourth step, the actual patterns are drawn on high-resolution photographic plates by the light table at 10 to 20 times final size. The plates are mounted on an x-y platform, which is driven by stepping motors. As the table is moved, under commands prepared by the computer, a light beam from a xenon flash lamp draws the mask pattern on the plate. The flashing of the lamp also is controlled by commands from the computer.

The light table can be moved in steps of ½ mil over a field of 2.2 x 2.2 inches at a rate of 200 steps per second. The absolute accuracy of the table within this range is ±75 microinches, and repeatability is better than ±50 microinches. When used with a high quality step-and-repeat camera and lens system, masks with 0.1 mil lines over 200 mil fields can be made with positional repeatabilities of ±15 microinches. In the final step, the exposed and developed plates are placed in a step-and-repeat camera to form a complete array of chip patterns at final size on photographic plates which, in turn, are used to expose the array of chip patterns on the semiconductor wafer.

The key development in the new process is the experimental language, which was designed to describe, easily, the circuit patterns from a rough sketch. With this language it is possible to define, by a simple code, anything that may appear in the circuitry, ranging from a small diffusion area to a complex arrangement of devices making up a logic gate. Having made these definitions and stored them in a tape library, the designer can specify the circuit layout in a skeleton form, forgetting about the details of geometry, such as line spacing and diffusion widths.

The language contains a hierarchy, so that a transistor can be defined by a simple instruction built up from a set of instructions which specify its detailed structure. In turn, a higher level circuit configuration of many transistors can be defined with a single instruction. Such a facility permits a gradual accumulation of a library of parts which can be used over and over in different mask structures.

The language also contains a replication feature, so that a circuit or structure can be defined, and, with a simple command code, it can be replicated at any desired interval over the mask.

The efficiency of the new technique was proved in a trial exercise, during which four patterns of an insulated gate field effect transistor chip of 122 circuits were written in about one hour. Over 100 hours would be required to cut artwork by commercial techniques.

AUTOMATED TV MASTER CONTROL

An automatic master control for the studios of Albury/Upper Murray TV station AMV4 has been designed and built by the station engineering staff and is now in operation.

This equipment was designed and built entirely at AMV4 by the technical department under chief engineer Bob Jones. About three months were spent at the drawing board and actual construction started in January, 1966. The work of building and installing the equipment had to be carried out in between operational requirements and normal maintenance and as a result took a little over a year. Excluding the cost of labour, the complete equipment fully installed and integrated with the existing system cost about $4,000 and was very close to the estimated cost.

Fairchild Australia Pty. Ltd., has awarded the station its inaugural Fairchild Project Award, which is to be awarded to one of its customers every two months.

To appreciate the problems which the automatic control system is designed to overcome, it is an advantage to have some idea of the way a studio control room functions. In a manual controlled studio, separately manned sound and vision mixers are required, equipped with remote controls for operating telecine and tape equipment. Switching operations to bring these various sources on air in sequence at precisely the right moment are often complex and have to be carried out rapidly, so are subject to error.

The new electronic control unit at AMV-4 is designed to carry out these functions automatically. The control unit, which contains a 10-event memory bank, controls the operation of all the equipment used in program presentation, and switches program video and audio. It can operate entirely automatically from cues on films, cartridge tape and videotape; or manually by means of a "cue" or "take" push-button; or part manually and part automatically. The unit allows the studio to be operated by only two technicians, who are required only to reload telecine, video tape and cartridge tapes, and recode program information into the memory banks as the events are used, by means of push-button type controls on the console.

The equipment records the information fed to it by the console operator in digital code, and each program source is assigned a specific code. For instance, the station has two film projectors and one slide projector in its telecine chain. The codes for these are:

Projector 1	0001
Projector 2	0010
Slide	0011

Each memory cell can record any one of 16 (2^4) different program sources, thus allowing considerable scope for future expansion.

Each memory cell uses four bistable multivibrators (flip-flops). Initially, all four flip-flops are steered into the same stable state by means of the reset inputs. When access to this memory is required, any code generated by the encode push-button is passed to the set inputs of the flip-flop. If this code is 0001, flip-flop 4 will change to the second stable state. Each memory is read out in turn to become the next event, and when this memory is read out, the code 0001 recorded in the flip-flop is transferred to decoders.

The information stored in digital code is displayed to the operator by means of a bank of indicator lamps. The next event to go to air is displayed in the indicating push buttons used to code up the memories.

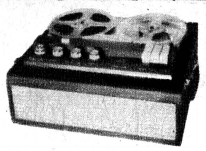
The operation of the next event to go to air is controlled by a 10 - second count, derived by dividing the 50Hz vertical drive pulse from the station synchronising pulse generator to produce a one second count. This is further counted by a modulo 10 counter, with each count decoded to produce the 10-second cycle. At minus 10 seconds (the arrival of the cue pulse) the projector begins to roll. At minus 2 seconds, the "projector show" is operated, and the vision and sound switch occurs. This allows an eight-second run-up time (really intended to ensure video tape stability, when program is taken from this source, but also applied to the film projectors for convenience). At minus 1 second, the read out is stepped on to the next memory and at 0 second the count resets, ready for a new cue.

To achieve maximum flexibility in presentation, vision source and sound source are recorded independently in the memory bank, and random access is available to individual memories to allow last minute program changes. Transition between two events, by means of cut, fade or wipe, is recorded in the memory bank. The equipment controls circuits are integrated with the vision and sound switching circuits and a single board for, say, a telecine chain, could contain all gates for film and slide projector operations and interlock as well as vision and sound control, and could be repeated for the number of telecine chains required.

The equipment is designed for the minimum of maintenance. There is no setting up procedures, and only a few pre-set controls are used. It is entirely solid state, and uses microcircuits for all memory, gating and counting functions; switching transistors for operating indicator lights and controlling program equipment: and MOSFET transistors for switching video and audio. More than 500 microcircuits and 250 transistors are mounted in a single matrix board measuring 30 x 18in. This high packing density is achieved only because direct wiring between microcircuits is required and relatively few additional components are needed.

The "open plan" type of layout for the logic matrix was chosen so that changes in design could be readily made in the light of experience, but it is clear that modular construction could be used with advantage. For instance, each memory circuit in the sound and vision sections are identical; 20 of them are required for a 10 event store.

The memory is programmed by push buttons on the control console. Indicator lights tell the operator how many events are still in the memory.



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Features three heads, three motors, three speeds. Frequency response at 7½ i.p.s. is 30-17,000 Hz., plus or minus 2 db. Write for details and copies of reviews. Price now reduced. R 104 **$189**

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"Aristocrat" mylar tape is available in these sizes: 7 in. 1800 ft. **$3.70.** 7 in. 2400 ft. **$5.60.** 7 in. 3600 ft. **$7.65.** Other "Aristocrat" sizes: 5 in. 900 ft. **$2.10.** 5 in. 1800 ft. **$4.40.** 4 in. 600 ft. **$1.35.** 3 in. 225 ft. **$0.95.** This is the first time high quality recording tape has been offered in Australia at these prices.

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The all new Janszen Z600 speaker system is revolutionary in design and construction — provides a magnificent "transparent" sound. Response is 30 to beyond 30,000 Hz. The natural treble response results from the use of Series 130 Janszen mid/high range radiators—electrostatic units with 176 push-pull sheathed conductors. The bass reproducer is the Janszen Model 350B dynamic. Impedance is 8 ohms only. Encel price is $178 for the Z600 . . . and the cabinet can only be described as a masterpiece. Finish is oiled walnut. Truly an audiophile's delight. Ask for copies of elated reviews **$178**

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The Nikka-Lustre tone arm Model C.P.3 is a beautifully engineered instrument which will track down to ½ gram with suitable cartridges. An open-front head shell accepts all standard ½" mounting cartridges — and the arm takes Ortofon and SME shells without modification. Miniature ball races are used throughout — an outrigger bias adjustment sets stylus pressure. A tailored lifting/lowering device is now available for this arm ($7.50). See the review in "Electronics Australia", p. 123, October, 1966. Write for copies **$19**

Celestion Studio Series

CELESTION "STUDIO SERIES" LOUDSPEAKERS

The "Celestion" Deluxe Model CX2012 is rated at 20 watts RMS and frequency response is **conservatively quoted** as 30-18,000 Hz. A special "Brilliance" **control** operates in the tweeter circuit — **the electrical cross-over** is at 4 kHz. **See** reviews in the "Gramophone" p.511, April, '65, and "Hi-Fi News" p.75, June, '65. ENCEL PRICE: CX2012 .... **$59**

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IF THERE'S A BATTLE OF THE COMPACTS . . . THE CELESTION "DITTON 10" IS WELL TO THE FORE

Many music lovers require compact speaker systems . . . and tape recording enthusiasts find the addition of external speaker systems makes an astounding difference to performance. Although only 12" x 6½" x 8¼" the "Ditton 10" incorporates two units, the bass reproducer being a specially designed "long throw" model which extends LF response. Power handling capacity is 10 watts R.M.S. Both 3 and 15 ohm impedances are available . . . the 3 ohm model is ideal for use with solid state amplifiers and tape recorders. See the reviews in "Hi-Fi News", p.433, Oct., '65, and the "Gramophone", p.41, June, '65. Write for copies of these enthusiastic reports. The "Ditton 10" is beautifully finished in teak or walnut veneers. These compact systems are used by one of Australia's leading universities to reinforce sound in the auditorium ... **$59**

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FIJI — radio hub of the South Pacific

Radio plays an important part in the everyday life of Fiji, one of the jewels of the Pacific, and one of the last of Britain's Crown Colonies.

by Michael Terry

The Australian who visits Fiji will find the broadcasting set-up very different to that which exists in Australia, with its network of national and commercial stations. The Fiji Broadcasting Commission operates all the stations, but finances their operation from advertising revenue. With three ethnic groups to be catered for — European, Fijian and Indian — broadcasts have to be on a trilingual basis. Since the total population is only half a million, it is surprising to learn that the organisation made a profit of £F21,500 in 1965. In that year, the FBC collected £F131,000 — £F45,000 from radio licences and a further £F86,000 from advertising revenue — and operating costs amounted to £F110,000.

The licensing system is rather different to that used in Australia. Each set has to be licensed, regardless of how many are possessed by a household, but whereas F25/ is charged for the first licence, each additional licence costs only F15/. The large number of unlicensed receivers is a problem, and the figure is thought to have risen sharply since the arrival of the battery operated transistor radio. Now it is possible for every bure (thatched native hut) to operate a radio, since mains power is no longer a factor, and the impossibility of policing every village is tacitly acknowledged by the authorities.

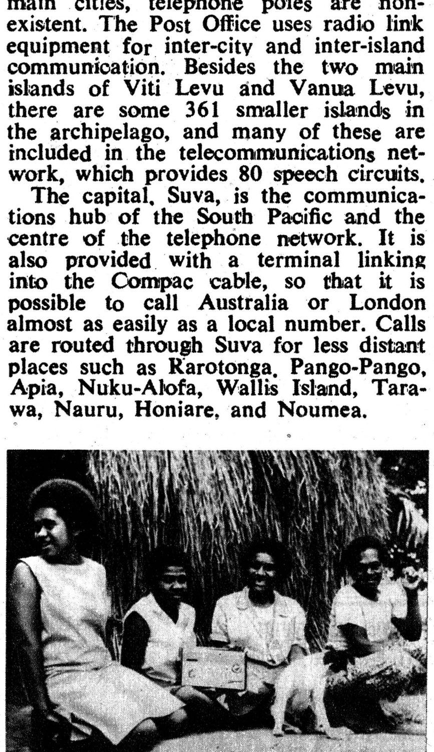
Broadcasting began in 1936 when station ZJV was inaugurated by Amalgamated Wireless (A'sia) Ltd., with English language programs only. All broadcasting became a Government controlled monopoly with the formation of the Fiji Broadcasting Commission, and the Fijian broadcasts were introduced to cater for the native population. Hindustani was added during World War II for the large Indian community. In 1954 the programs were rescheduled and expanded and the staff reorganised. In view of the similarities between the Fijian and New Zealand broadcasting systems, staff was trained by New Zealanders. There are now 9 Fijians, 11 Indians and 17 Europeans keeping Radio Fiji on the air.

At present Radio Fiji is operating on five medium wave and four short wave frequencies, with simultaneous broadcasts in the English, Fijian and Indian languages. I use the word "languages" guardedly, as there are dialects in use of all three languages, as well as the standard languages. When Ratu Cakobau ceded Fiji to Queen Victoria in 1874 there already existed dialects among the tribes, and these still persist. In more recent years, a general tongue has developed which all Fijians understand, but despite this spelling has not yet been formalised, and divergences between the spelling and pronunciation of some words is apt to puzzle the visitor. Some attempt has been made to introduce a phonetic spelling, but this has only compounded the confusion, since both forms now exist in print.

The main snag in the traditional spelling is that there is an "n" hidden behind every "d" and an "m" behind every "b". For example, the town of Labasa is pronounced "Lambasa," Lakeba, is "Lakemba," Nadi (the international airport) is "Nandi." A European substituting for a Fijian as announcer or news reader has to be carefully trained in the idiosyncracies of the language, otherwise he would make a hash of a lot of words.

So much for the broadcasting. Whatever the Fijians may think of the set-up, they certainly have no cause for complaint in the colony's modern and efficient telephone network. Outside of the main cities, telephone poles are nonexistent. The Post Office uses radio link equipment for inter-city and inter-island communication. Besides the two main islands of Viti Levu and Vanua Levu, there are some 361 smaller islands in the archipelago, and many of these are included in the telecommunications network, which provides 80 speech circuits.

The capital, Suva, is the communications hub of the South Pacific and the centre of the telephone network. It is also provided with a terminal linking into the Compac cable, so that it is possible to call Australia or London almost as easily as a local number. Calls are routed through Suva for less distant places such as Rarotonga, Pango-Pango, Apia, Nuku-Alofa, Wallis Island, Tarawa, Nauru, Honiare, and Noumea.



The transistor radio has proved a great boon to native Fijians without mains power.

One of the activities of the Posts and Telegraphs Department is the humanitarian one of maintaining a 24-hour-a-day radio watch for calls from vessels in distress. Flying boats of the Royal New Zealand Air Force based in Suva played an important part in air-sea rescue operations in the past, but the base has unfortunately now been closed.

Radio plays a big part in medical treatment in Fiji, as it does in Australia with its Flying Doctor Radio Service. Local medicos who are not sure how to handle a complex case contact medical authorities in Suva for specialist advice. Urgently needed medical supplies can also be flown to remote locations should circumstances demand it. Recently, a New Zealand Air Force plane flew oxygen in cylinders to an island north of Samoa to save the life of a child.

To round off this survey of radio in Fiji, here is a summary of the amateur radio activity in the colony. Although 24 amateurs are licensed, only eight are now active. At one time there was a Sunday morning "mosquito network" but this has gradually faded out. Bill Erick, a wealthy retired American cattleman from Nevada, operates a station on the small island that he now owns, not far from Suva. He uses a 50ft mast, and regularly contacts W6AL at Lodi, California, for the latest news from the States. On the occasions when he visits his homeland, Bill Erick keeps in touch with Fiji through VR2DI.

All the amateurs are on Viti Levu, the principal island of Fiji, except Frank Fleming, who is the caretaker on Nukulau Island, a resort belonging to the Royal Suva Yacht Club, and located nine miles from the capital. Frank, callsign VR2AU, was the first person to fly an aircraft to Fiji. Malcolm Gray, VR2BJ, contacts his brother in South Australia. Graeme Johnson, VR2FF formerly of the RNZAF, keeps in touch with his father in Timaru, who operates ZL3J0. The only Fijian amateur is Wangga-i-Rawai (spelt phonetically) whose call sign is VR2EP, and the sole Indian is Raj Singh, VR2ER.

It is not easy to obtain an amateur licence in Fiji, because the examination is a stiff one. The licence fee is only F30/ a year (equivalent to about $A3.40). Receivers come in duty-free, but transmitters and parts used in their construction are subject to duty, amounting to 25 per cent on goods from Commonwealth countries, and 45 per cent elsewhere.

One last point—Fiji has no television service as yet—but who would want it in this tropical paradise.

Technical Review

Parametric Amplification of Far-Infrared Light

The first parametric amplification of far infrared light has been achieved. Tellurium, an elemental semiconductor, was used to achieve a 3dB gain in intensity of laser light at a wavelength of 17.9 microns.

Parametric amplification of far infrared light is important as a means of increasing the intensity of light from a weak source, and is a first step toward constructing a parametric oscillator. Optical parametric amplifiers and oscillators are of considerable interest for possible use in future laser communications systems and the study of the nature of optical materials.

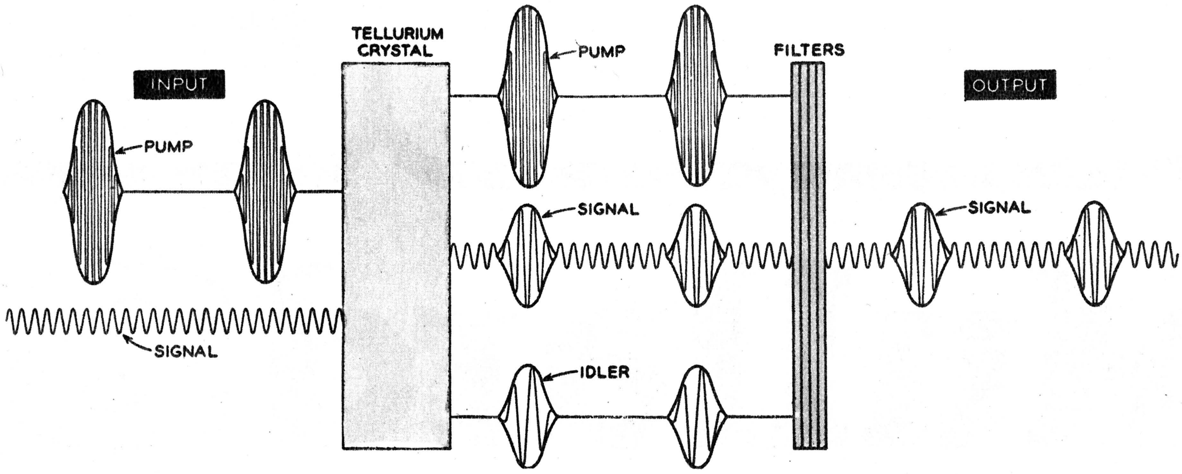
In optical parametric amplification, three light waves of different frequencies interact within a nonlinear material (in this case, tellurium). Energy from one wave, at the "pump" frequency, is transferred to two other waves: the signal wave, which is amplified, and the "idler" wave, which is generated as a by-product of parametric amplification. The frequency of the idler wave always equals the pump frequency minus the signal frequency.

The energy source in the experiment, conducted by Dr C. Kumar N. Patel, of Bell Telephone Labs., is a carbon dioxide laser, which supplies the pump power — 10.6-micron radiation in 10-kilowatt pulses, at a rate of 160 pulses per second. The light to be amplified, the signal frequency, is supplied by a helium-neon laser that generates 10 microwatts of continuous wave (CW) power at a wavelength of 17.9 microns. The idler wave has a wavelength of 25.9 microns.

Tellurium has two properties which make it especially effective as a medium for parametric amplification. First, it is the most nonlinear material known. That is, there is a nonlinear relationship between the amount of electric polarisation induced in the tellurium crystal and the electric field applied to the crystal by the laser light waves. Within a nonlinear material — the only type suitable for parametric amplification — light waves of different frequencies can interact, and energy from one light wave can be transferred to another. Because of tellurium's high co-efficient of nonlinearity, the energy transfer from the pump radiation to the signal frequency is very efficient.

Tellurium is also birefringent; that is, it has different optical properties in different directions. The velocity of light passing through a birefringent crystal depends on the direction of its path through the crystal. For example, when Dr Patel directed both laser beams through the tellurium crystal at an angle of 7 degrees from its optic axis, he found that the interaction between the waves at the pump frequency, the signal frequency and the idler frequency was phase-matched. Phase-matching strengthens parametric amplification by lengthening the optical path along which the three light waves interact.

In the experiment, the light beams from the carbon dioxide laser and the helium-neon laser are combined into one beam and focused into a 7mM-long tellurium crystal. The light output from the crystal is passed through filters which block the 10.6-micron pump radiation and the 25.9-micron idler wave, but allow the 17.9 micron signal to pass with minimum attenuation. The 17.9-micron signal radiation, a CW input to the tellurium crystal, showed pulses of about 3dB gain at the output of the crystal. The pulses were coincident with the pump pulses from the carbon dioxide laser, verifying that parametric amplification had occurred in the tellurium crystal. ("International Electronics," April- May, 1967.)



Three light waves of different frequencies interact within crystal to produce amplification. Energy from one wave, at the "pump" frequency, is transferred to the signal wave, which is amplified, and the idler wave, which is a by-product of the parametric amplification. Pulses of about 3dB gain in the output signal coincide with the pump pulses

"DISTANT ELECTRIC VISION" ANTICIPATED MODERN TV

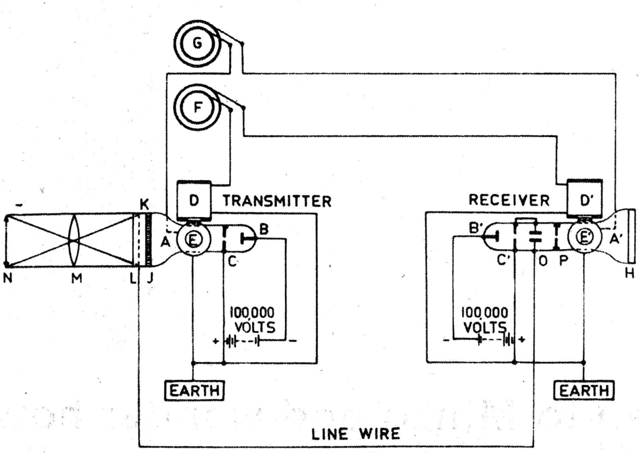
"Distant Electric Vision" was the name given by English scientist Mr. A. A. Campbell-Swinton to a system proposed by him in 1911 for instantaneous transmission by wire of motion picture images. The remarkable thing about the proposed system was that its operating principles were basically the same as those used in television today, as can be seen from the following extract from the address.

So long ago as the year 1908, in connection with a paper published in "Nature" by the late Mr Shelford Bidwell, I wrote a letter in that journal suggesting that the difficulty of obtaining the necessary enormous numbers of synchronised operation per second could possibly be solved by the employment of two beams of cathode rays, one at the transmitting and one at the receiving station, synchronously deflected by the varying fields of two electromagnets placed at right angles to one another and energised by two alternating electric currents of widely different frequencies, so that the moving extremities of the two beams would be caused to sweep synchronously over the whole of the required surfaces within the one-tenth of a second necessary to take advantage of visual persistence; and that, so far as the receiving apparatus was concerned, the moving cathode beam would only have to be arranged to impinge on a sufficiently sensitive fluorescent screen, and, given suitable variations in its intensity, to obtain the desired result.

As, since that date, I have several times been asked to explain more in detail this idea, I now propose to do so, though it must be distinctly understood that my plan is an idea only, and that the apparatus has never been constructed. Furthermore, I would explain that I do not for a moment suppose it could be got to work without a great deal of experiment, and probably much modification. It is, indeed, only an effort of my imagination, and can be useful merely as a suggestion of a direction in which experiment might possibly secure what is wanted. What, however, is claimed is that, so far as I am aware, it is the first suggested solution of the problem of distant electric vision in which the difficulty of securing the required extreme rapidity and accuracy of motion of the parts is got over by employing for these parts things of the extreme tenuity and weightlessness of cathode rays. Indeed, apart from the revolving armatures of the alternators employed for synchronisation which present no difficulty, there is no more material moving part in the suggested apparatus than these almost immaterial streams of negative electrons. Further, as will be seen, only four wires, or three wires and earth connections at each end, are required.

In the diagrammatic illustration the transmitter is shown on the left-hand side and the receiver on the right-hand side. The transmitter consists of a Crookes tube A fitted with a cathode B, which sends a cathode-ray discharge through a small aperture in the anode C, the cathode rays being produced by a battery or other source of continuous electric current giving some 100,000 volts. D and E are two electromagnets placed at right angles to one another, which, when energised by alternating current, will deflect the cathode rays in a vertical and in a horizontal direction respectively.

The receiving apparatus consists similarly of a Crookes tube A' fitted with a cathode B', which, in circumstances to be further described, transmits cathode rays through an aperture in the anode.



C', D' and E' are two electromagnets placed at right angles, similar to those in the transmitter, the two magnets D and D', which control the vertical motions of the cathode-ray beam, being energised from the same alternating dynamo F, which has a frequency, say, of ten complete alternations per second; while the other two magnets E and E', which control the horizontal movements of the cathode-ray beam, are energised by a second alternating dynamo G having a frequency of, say, 1,000 complete alternations per second.

In the receiver H is a fluorescent screen, upon which, under conditions to be further described, the cathode rays impinge, and the whole surface of which they search out every tenth of a second under the combined deflecting influence of the two magnets D' and S', with the result that under these conditions the screen fluoresces with what appears to the eye as a uniform brilliancy.

Similarly, in the transmitting apparatus, the cathode rays fall on a screen J, the whole surface of which they search out every tenth of a second under the influence of the magnets D and E. Further, it is to be remarked that as the two magnets D and D' and the two magnets E and E' are energised by the same currents, the movements of the two beams of cathode rays will be exactly synchronous, and the cathode rays will always fall on the two screens H and J on each corresponding spot simultaneously.

In the transmitter the screen J, which is gas-tight, is formed of a number of small metallic cubes insulated from one another, but presenting a clean metallic surface to the cathode rays on the one side, and to a suitable gas or vapour, say sodium vapour, on the other. The metallic cubes which compose J are made of some metal, such as rubidium, which is strongly active photoelectrically in readily discharging negative electricity under the influence of light, while the receptacle K is filled with a gas or vapour, such as sodium vapour, which conducts negative electricity more readily under the influence of light than in the dark.

Parallel to the screen J is another screen of metallic gauze L, and the image to be transmitted of the object N is projected by the lens M through the gauze screen L on to the screen J through the vapour contained in K. The gauze screen L of the transmitter is connected through the line wire to a metallic plate O in the receiver, past which the cathode rays have to pass. There is, further, a diaphragm P fitted with an aperture in such a position as, having regard to the inclined position of B', to cut off the cathode rays coming from the latter and prevent them from reaching the screen H unless they are slightly repelled from the plate O, when they are able to pass through the aperture.

The whole apparatus is designed to function as follows:

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Mini-fi is revolutionary!

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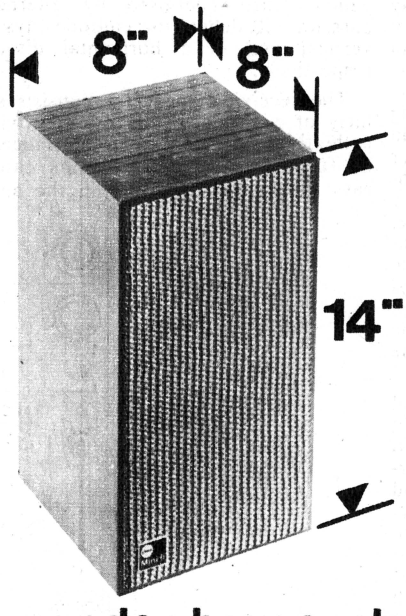
it's powerful 15 Watts RMS

it has fantastic response

35 Hz to 18,000 Hz (±6 db)



Listen to Mini·fi and wonder how such magnificent sound can come from so small an enclosure

Small enough to bring stereo into any home and powerful enough to handle the maximum output of most high fidelity amplifiers, the Mini-fi has proved to be eminently satisfying to even the most discerning hi-fi enthusiasts.
The new powerful high compliance, long excursion Rola C65-0 woofer (available only as an integral part of the Mini-fi system) and the improved Rola 5FX tweeter combine to produce Mini-fi's outstanding frequency response. When used with an amplifier supplying 6 db of bass boost at 100 Hz Mini-fi provides brilliant response from 35 Hz to 18,000 Hz (± 6 db under anechoic conditions).
See the June edition of "Electronics Australia" for complete specifications on Mini-fi—or contact Rola Division direct.

Plessey Components Group

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Richmond E1 Victoria Telephone 42 3921

NSW Plessey Components Group Rola Division Box 2 PO Villawood Telephone 72 0133

Assume a uniform beam of cathode rays to be passing in the Crookes tubes A and A' and the magnets D and E and D' and E' to be energised with alternating current, as mentioned. Assume, further, that the image that is desired to be transmitted is strongly projected through the lens M through the gauze screen L on to the screen J. Then, as the cathode rays in A oscillate and search out the surface of J, they will impart a negative charge in turn to all the metallic cubes of which J is composed. In the case of cubes on which no light is projected, nothing further will happen, the charge dissipating itself in the tube; but in the case of such of those cubes as are brightly illuminated by the projected image, the negative charge imparted to them by the cathode rays will pass away through the ionised gas along the line of the illuminating beam of light until it reaches the screen L, whence the charge will travel by means of the line wire to the plate O of the receiver. This plate will thereby be charged; will slightly repel the cathode rays in the receiver; will enable these rays to pass through the diaphragm P, and, impinging on the fluorescent screen H, will make a spot of light. This will occur in the case of each metallic cube of the screen J, which is illuminated, while each bright spot on the screen H will have relatively exactly the same position as that of the illuminated cube of J.

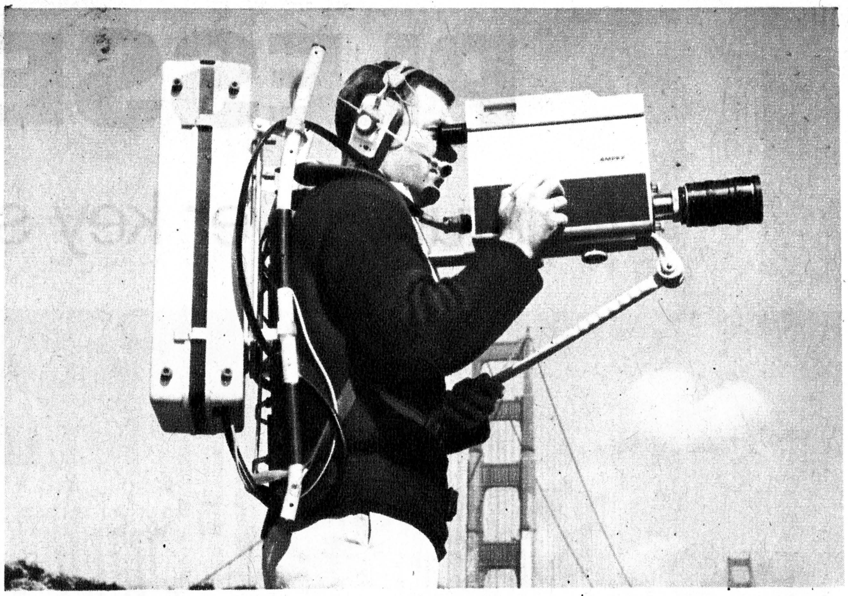
Consequently, as the cathode-ray beam in the transmitter passes over in turn each of the metallic cubes of the screen J, it will indicate by a corresponding bright spot on H whether the cube in J is or is not illuminated, with the result that H, within one-tenth of a second, will be covered with a number of luminous spots exactly corresponding to the luminous image thrown on J by the lens M, to the extent that this image can be reconstructed in a mosaic fashion. By making the beams of cathode rays very thin, by employing a very large number of very small metallic cubes in screen J, and by employing a very high rate of alternation in the dynamo G, it is obvious that the luminous spots on H by which the image is constituted can be made very small and numerous, with the result that the more these conditions are observed the more distinct and accurate will be the received image.

Furthermore, it is obvious that, by employing for the fluorescent material on the screen H something that has some degree of persistency in its fluorescence, it will be possible to reduce the rate at which the synchronised motions and impulses need take place, though this will only be attained at the expense of being able to follow rapid movements in the image that is being transmitted.

It is further to be noted that as each of the metallic cubes in the screen J acts as an independent photoelectric cell, and is only called upon to act once in a tenth of a second, the arrangement has obvious advantages over other arrangements that have been suggested, in which a single photoelectric cell is called upon to produce the many thousands of separate impulses that are required to be transmitted through the line wire per second, a condition which no known form of photoelectric cell will admit of.

Again, it may be pointed out that sluggishness on the part of the metallic cubes in J or of the vapour in K, in acting photoelectrically, in no wise interferes with the correct transmission and reproduction of the image, provided all portions of the image are at rest; and it is only to the extent that portions of the image may be in motion that such sluggishness can have any prejudicial effect. In fact, sluggishness will only cause changes in the image to appear gradually instead of instantaneously.

Many modifications are, of course, possible in detail. For instance, the plate O of the receiver might perhaps better be replaced by an electromagnet or solenoid so arranged as to repel the cathode beam when energised. Again, the somewhat crude form of photoelectric cell described, composed merely of insulated cubes of rubidium in contact with sodium vapour, might be improved upon. Indeed, it is highly probable that research will reveal much more sensitive materials, the use of which would vastly improve this part of the apparatus, which at present is probably the one least likely to give the desired results. ["Proceedings Of The Institute Of Radio And Electronics Engineers Australia," Vol. 27, No. 11 (November, 1966). The article was originally published in "Nature" in 1911.]



PORTABLE VIDEOTAPE RECORDER

A battery-powered portable videotape recorder and camera combination weighing less than 50lb and designed primarily for remote high speed taping of news events by a single operator has been placed on the market in U.S.A. by Ampex Corporation.

The new Model VR-3000 recorder is the smallest standard broadcast recorder ever built, according to Ampex. It produces either high-band or low-band monochrome tapes that may be immediately replayed on the air on any standard transverse (four-head) studio recorder. It also is capable of recording high band colour from studio colour cameras without modification. The recorder weighs only 35lb and in its attache-type carrying case measures 23 x $12\frac{3}{4}$ x 6in.

It records up to 20 minutes of video action and sound on an 8in reel of standard 2in wide video tape. The battery permits 20 minutes continuous recording without recharging, and an additional 20 minutes of preview operation of the camera only or live telecasting. Batteries are easily replaceable in the field, and a battery charger is included as a standard accessory. The camera employs a Plumbicon tube for high quality performance. It weighs 13 pounds, including an electronic viewfinder. It produces broadcast-quality monochrome pictures at light levels down to 30 foot-candles.

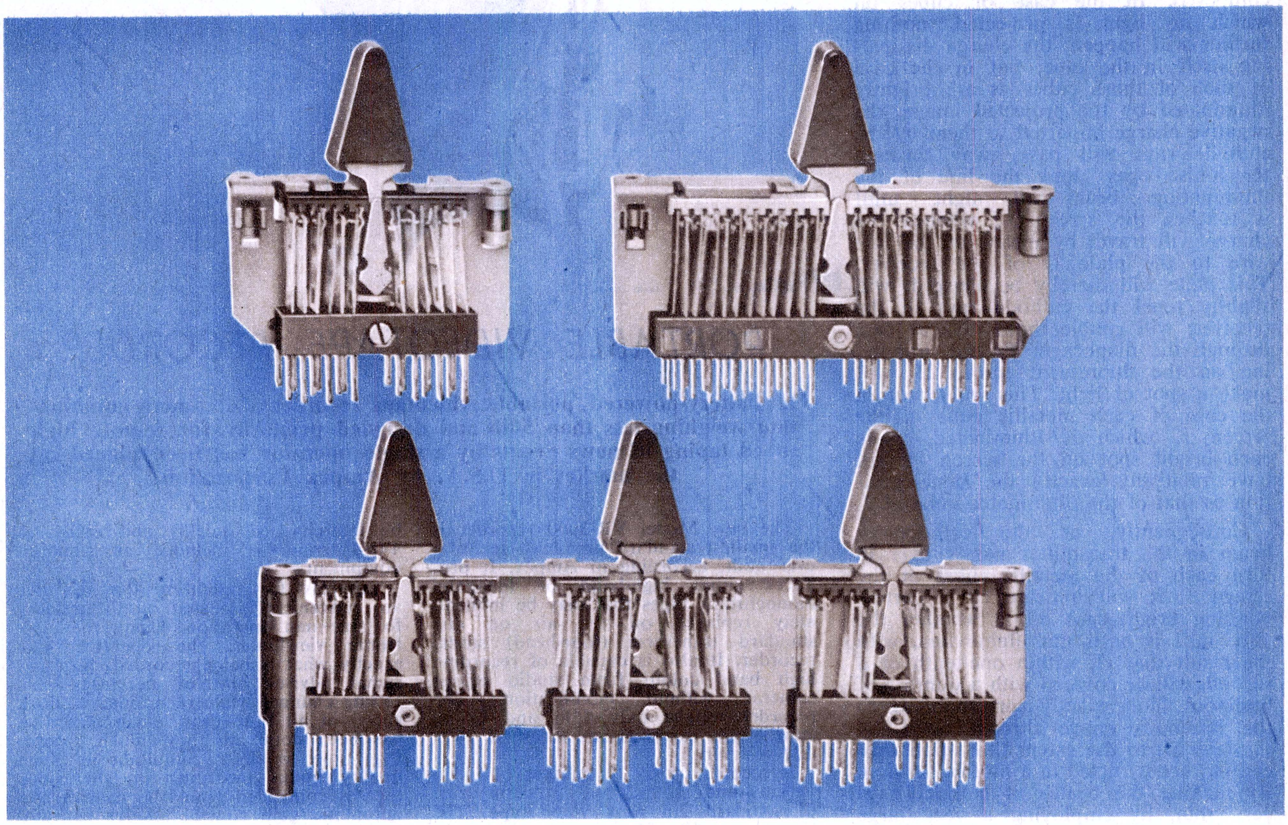
A shoulder harness attaches to the base of the camera with shoulder and abdomen supports to permit hand-held operation. The camera also may be used with a standard tripod. A standard lens mount permits use of various standard fixed or zoom lenses, which may be interchanged quickly and easily. A 4-to-1 zoom is included as standard equipment.

Controls for operating the recorder are conveniently located on the camera for one-man operation. Using the electronic viewfinder, the operator sees exactly what is being recorded. A visual signal advises him of necessary lens setting changes while recording. A clock shows at all times how much recording has been done and how much recording time is left. Simultaneous high quality audio recording on the video tape is controlled from the camera. An automatic gain control assures constant level of sound without monitoring by the operator.

The VR-3000 may also be used with standard television cameras for high-band or low-band colour or monochrome recording. It is offered either in 525-line or 625-line versions and may be easily converted from one to the other to permit recording on international TV standards. An accessory kit has the same dimensions as the recorder case and weighs approximately 40lb fully equipped. It has space for two spare reels of tape and two spare batteries, and includes battery charger, an auxiliary control and test unit for operation apart from the camera, and a battery eliminator which permits the recorder and camera to be operated from any normal AC power source.

PLESSEY

Miniature lever key switches



Illustrated above Top left. Single action key type N9300 Series.Top right. Large capacity key type N9900 Series. Bottom. Multiple key unit.

The Ducon Division of Plessey Components Group offer a range of miniature lever key switches with the following features:—

Design Designed to meet the most demanding electrical, mechanical and styling requirements, these compact, space saving switches provide a ready solution to light-current switching problems. All are fully tropicalised and meet the requirements of both British Post Office Specification D2162 and Interservices RCL 153 Pattern 3.

Contacts There is a wide range of contact arrangements which are adequate for most general applications. Switches are normally supplied with silver contacts. However, gold, platinum or palladium are available if required.

Key Handles Handles are available either in a standard black with ivory insert or from a choice of many self-colours with contrasting tip inserts to provide easy identification.

Reliability Extended life tests have indicated negligible wear or loss of contact pressure after one million operations.

Dimensions Width 39/64″, Depth 2-3/16″. Height — Single unit 1¾″, 2 unit 3¼″, 3 unit 4¾″, 4 unit 6¼″.

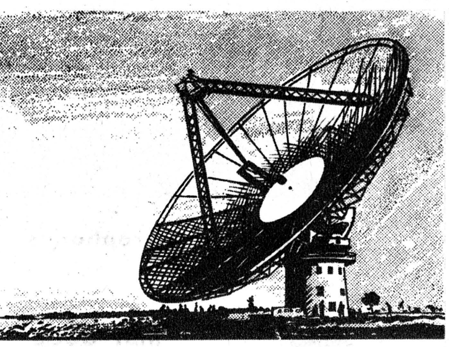
A standardised range is available ex stock. Literature is available on request to:—

Plessey Components Group

Ducon Division Box 2 PO Villawood NSW

Telephone 72 0133

SCIENTIFIC AND INDUSTRIAL NEWS



New TV translators

Three country areas in Victoria — Portland, Alexandria and Eildon — will receive better quality television soon, following a Government decision to allow the establishment of translator stations in these areas. Each area will have translators for both the national and commercial services.

Acting Postmaster-General, Senator K. Anderson, said the A.B.C.B. had recommended the establishment of the translators following a detailed investigation into the requirements of each area.

Rural telephones

Telecommunications Company of Australia Pty. Ltd. and its subsidiary Commonwealth Electronics Pty. Ltd. have been awarded P.M.G. contracts worth about $270,000 for the supply of 150 single channel VHF and UHF radiotelephone terminals and associated equipment. The terminals, which are fully solid-state and provided with telephone dialling facilities, will be used for rural trunk line service by the Post Office.

The contract follows a previous order from the P.M.G. for 100 similar terminals. These are the first fully solid-state UHF and VHF radiotelephone terminals to be designed to trunk line standards in Australia. Included in the contract are VHF radiotelephone units which will be used to replace existing low-grade earth-return services to remote subscribers in rural areas.

Pyroelectric thermometers

A recent study at the N.B.S. Institute for Materials Research in U.S.A. investigated the feasibility of using pyroelectric materials as thermometer sensors to measure minute temperature changes in the cryogenic region. Pyroelectric materials are asymmetrical crystals that become polarized by changes in temperature. The bureau's investigation centred about the examination of three types of commercial ceramic materials for use as possible sensing elements. Two of the compounds were principally composed of lead zirconate titanate while the third compound consisted mainly of barium titanate.

The phenomenon of pyroelectricity was first observed in Europe in 1703 by Dutch traders who had acquired tourmaline crystals in Ceylon for gemstones. The traders noticed that the tourmaline, when placed in a fire, first attracted ashes and then repelled them. Since that time, scientific research has revealed that pyroelectric crystals can be regarded as having a built-in or permanent electric polarisation. When such a crystal is held at constant temperature, this polarisation is not evident. However, when the temperature of the crystal is raised a small amount, the magnitude of the polarisation changes. Conversely, if the temperature of the material is lowered by the same amount, the absolute magnitude of the change in polarisation is the same, but the direction of the change is reversed. Research has shown that a thermometer employing such materials as sensors would make possible the measurement of temperature differences smaller than one millionth of a degree, a limit now unobtainable.

CRT development

The Marconi Company Ltd., of Chelmsford, Essex, U.K., has introduced a new electromagnetic lens which can produce a spot of light on a cathode ray tube screen so small that it can write a line finer than a human hair. It enables high concentration of data to be presented on CRT displays of the type used in radar and computer systems. The device, Type F 1500, operates with such accuracy that, in use with any high quality display tube, it can focus the electron beam to produce a spot size of one-fifth of a millimeter in the central region of the screen and in other areas a spot size never more than twice this diameter.

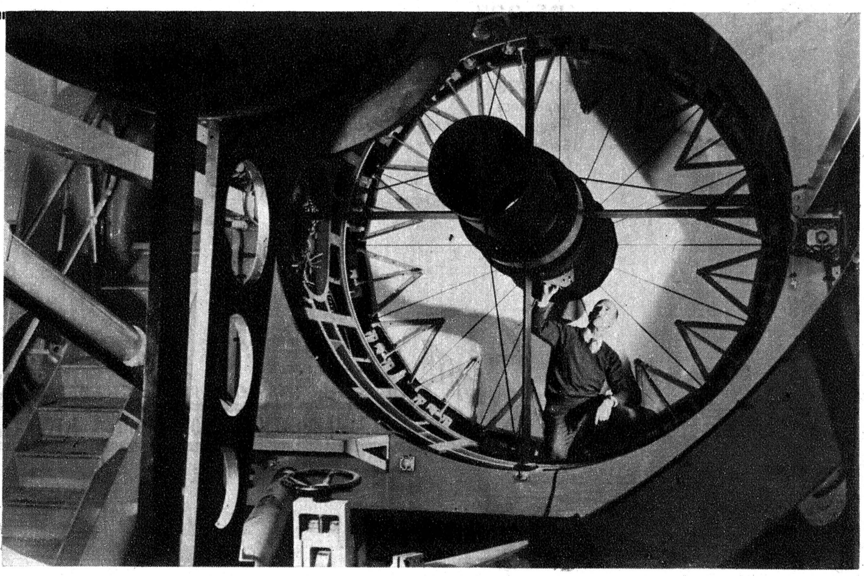
Throughout the whole assembly the magnetic parts are made of mumetal which minimises remanence or hysteresis effects which would otherwise complicate the adjustment of the unit when it was being set up. The focus coil is shielded with mumetal to ensure the best possible symmetry of the focusing field.

Thermistors are employed with the alignment and astigmatism correction coils to compensate for changes in temperature over the range from −10 deg. C. to +70 deg. C. The coils and the thermistors are encased in high compression plastic mouldings which have interlocking surfaces.

The assembly can be used with all types of magnetically deflected cathode ray tubes with neck diameters up to 35 millimetres. Where the neck of the tube cannot accommodate the whole of the unit one or two of the correction coils can be omitted.

The focus coil unit is made up of seven annular shaped sections, bolted together to form a compact cylinder which fits over the neck of a cathode ray tube. There are three alignment coils, a focusing coil, and two coils which correct for astigmatism in the electron beam. Furthest from the cathode ray

An inspector examines the "petal" housing of Britain's new 98in Isaac Newton telescope, which will shortly be completed at the Royal Greenwich Observatory. It will be the largest in Western Europe. Within the circular area, panels shaped like petals open when the telescope is in use, but close to protect the mirror from dust and other foreign matter when it is not in use. The moving parts of the telescope weigh 87 tons and the mirror, weighing nearly five tons and measuring 98in across, has been polished to an accuracy measured in millionths of an inch.



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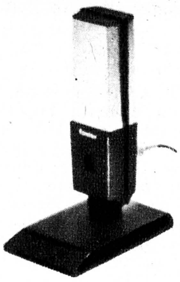
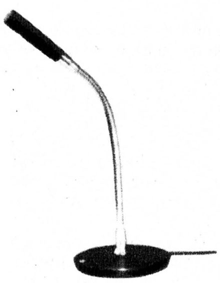


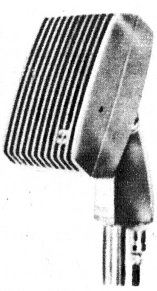
*MDF-600B cardioid microphone

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 100~10,000 c/s ±8 dB
†Sensitivity : −52 dB ±3 dB,
Dimensions : 148×48×34.5 mm without stand
Cable : 4 φmm, 3 m
Weight : 1¼ lbs (525 g)



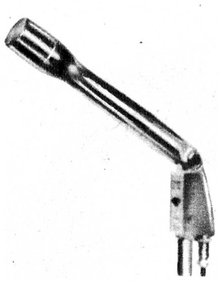
DF-1DE

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 150~10,000 c/s ±8 dB
†Sensitivity : −57 dB ±3 dB,
Dimensions : 385.5 mm high
21 mm diameter, microphone
128 mm diameter, stand
Cable : 4 φmm, 1.5 m
Weight : 1⅞ lbs (840 g) with cable



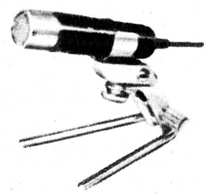
*DF-14B

SPECIFICATIONS
Impedance : 50 kΩ Variable
Frequency Response : 100~10,000 c/s ±8 dB
†Sensitivity : −48 dB ±3 dB,
Dimensions : 136×75×47 mm
Cable : 6 φmm, 4 m
Weight : 2 lbs (900 g)



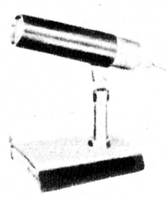
*DF-22B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 50~12,000 c/s ±7 dB
†Sensitivity : −57 dB ±3 dB,
Dimensions : 32.5 mm diameter, 220 mm long
Cable : 6 φmm, 4 m
Weight : 1¼ lbs (575 g)



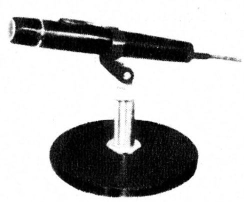
DF-1/*DF-1B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 100~10,000 c/s ±8 dB
†Sensitivity : −57 dB ±3 dB,
Dimensions : 21 mm diameter, 82.7 mm long
Cable : 3 φmm, 1.5 m
Weight : 3.9 oz (110 g) with cable



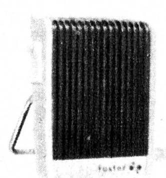
DF-3

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 50~12,000 c/s ±8 dB
†Sensitivity : −56 dB ±3 dB,
Dimensions : 33.5 mm diameter, 133 mm long
Cable : 4 φmm, 1.5 m
Weight : 9.0 oz (255 g) with cable



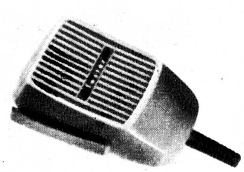
DF-12/*DF-12B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 80~12,000 c/s ±8 dB
†Sensitivity : −57 dB ±3 dB,
Dimensions : 23 mm diameter, 158 mm long
Cable : 3 φmm, 1.5 m
Weight : 6.3 oz (180 g) with cable



*DF-2B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 100~10,000 c/s ±10 dB
†Sensitivity : −56 dB ±3 dB,
Dimensions : 75×53×30 mm
Cable : 3 φmm, 1.5 m
Weight : 4.8 oz (136 g) with cable



*DF-51B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 150~8,000 c/s ±7 dB
†Sensitivity : −57 dB ±3 dB,
Dimensions : 98×58×36 mm
Cable : 6 φmm, 1.6 m, Coiled
Weight : 7.3 oz (207 g) with cable

* with switch : † at 1,000 c/s, 0 dB = 1 V/μ bar

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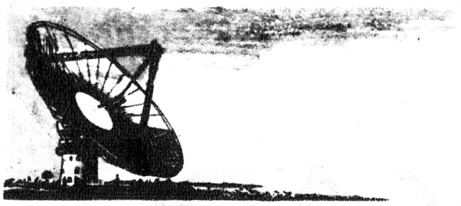
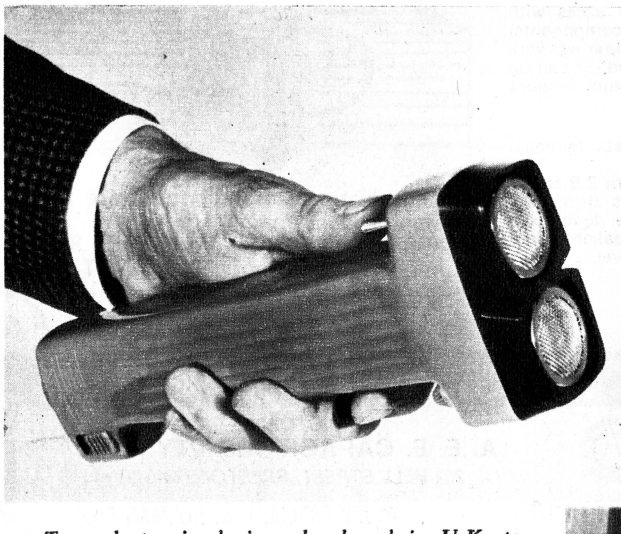


tube screen is the coil which corrects for any slight misalignment of the aperture plate, which is commonly used on high quality tubes to direct the electron beam leaving the cathode. This coil is separated from the remaining sections of the unit by a blank section, which is followed by two more alignment coils, which deflect the beam along a path directly down the centre of the tube, along the axis of the focus coil unit. The focus coil itself, which is next in line, contains static and dynamic coils carefully layer wound to ensure very accurate focusing. The remaining sections correct for astigmatism arising from the effects of the previous coil units. These are mounted at the end of the assembly, nearest the face of the CRT.

Air-transportable satellite terminals

Complete air-transportable satellite communications terminals are now being manufactured in Britain. The stations are for military use in the Anglo-American Initial Defence Communications Satellite Project. Three stations are already in operation manned by British Service units. The stations can be quickly dismantled into major components for shipment by air. The aerial can be broken down into sub-units which will fit into large military transports. The 65ft high radome which houses the complete station is a double-walled, air-inflatable structure which can be collapsed and stowed in an aircraft. Transmitting, receiving and other equipment are all housed in air-conditioned, thermally insulated containers. The containers are disposed around the central aerial in use, and for flight are unplugged and the door closed on each container.

The station also includes a microelectronic computer which has a number of functions. One of these is to introduce a variable delay in the system to provide a consistent signal as if all satellites were at a range of 25,000 miles, irrespective of the actual range. Another function of the computer is to control the acquisition of new satellites as they appear over the horizon. The initial steering is provided from prediction data fed into the computer by paper tape. The equipment automatically scans until signals are received, when the normal tracking system locks the aerial to the satellite.



Two electronic devices developed in U.K. to help blind people overcome their handicap. Right: an "electronic pen" enables blind people to fill a teapot without overspilling, tell when a baby's bottle is nearly full, judge how much liquid is left in a medicine bottle or glass of beer, pick out ripe from unripe fruit and other similar activities. Various tips are available for different functions—detecting temperature changes, the lights of a car, variations from magnetic north, etc. Above: This ultrasonic "torch" for detecting obstructions in the path of a blind person is now in full production in U.K. Ultrasonic waves are projected in a narrow beam, and are reflected back by obstructions to a receiver in the "torch."

"Seeing" with sound

Electronics experts at the Palo Alto Research Laboratory of the Lockheed Missiles and Space Co. are experimenting with a sub-surface detection system using sound waves. The company's project engineers have conducted research based on the knowledge that sound waves can be directed through murky water at an object and are developing techniques for translating reflected waves into a faithful image of the object. Under the Lockheed system, a stream of sound waves is aimed in a given direction. Sound waves reflected from an object are received, through an acoustical lens, by an image converter which changes the sound waves into electrical impulses for display on a TV screen.

The type of application envisaged for the equipment is exemplified by the incident of the H-bomb lost off the coast of Spain, at Palomares. On that occasion, submersible searching devices stirred up so much mud that boats trying to drag the bomb up had to wait long periods to allow the mud to settle after each pass. Lockheed officials are confident the bomb could have been located and recovered quite quickly had the new search system been available then.

Ultra-modern hospital

A private hospital in U.K. is to be equipped with a widespread closed circuit television system, a comprehensive nurse-call network and computing facilities, says a report in "Electronics Weekly." CCTV in all rooms will be used for entertainment purposes—switching in the broadcast services—and as a two-way vision-communications link between patients, nurses and doctors.

Short-wave radio will be used for audio communication and this will be switched over to a patient monitoring system if very ill patients are to be left unattended. Any change in patient condition such as failing respiration or heart rate, will be transmitted to a "bleep-bleep" system carried by the nurse.

Data processing facilities are planned for the hospital. It is hoped that this will be in the form of a computer installation rather than having to make use of time on another machine. The computer will handle administration, accounting and other statistical work.

Other devices such as a vacuum monorail system for delivering meals and medicines, and electrically adjusted beds, are also envisaged.

Fuel cells in action

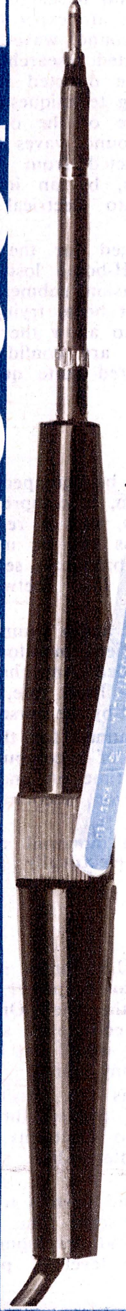
Fuel cells are being tested by U.S. forces in Vietnam as a substitute for diesel generators to provide power for communications use. A research scientist of the Shell Oil company in U.K., Mr Keith Williams, said the cells offer silent, portable power for military use. However, they would not be competitive with internal combustion engines for many years.

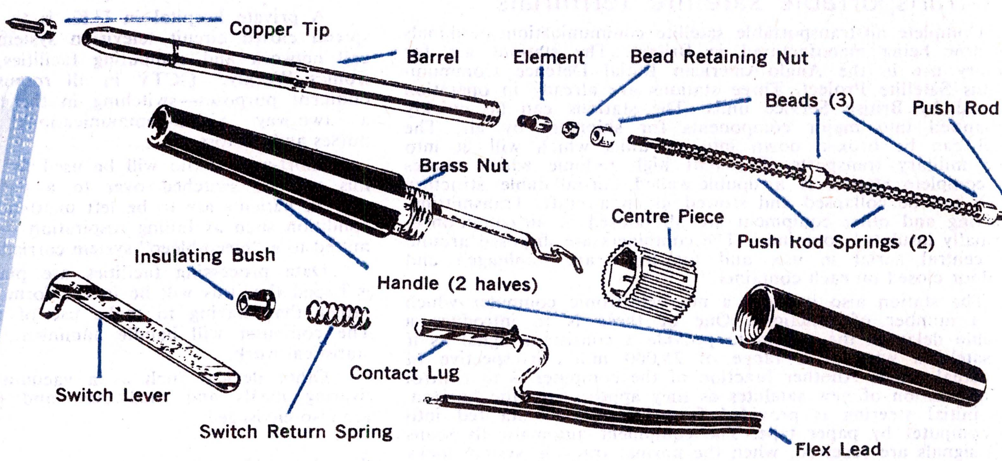
Fuel cells, regarded by many as the possible source of power for automobiles in the future. convert the energy of a fuel, such as hydrogen, directly into electricity by chemical action. Thus, it dispenses with the intermediate stage requiring fuel to be burnt to power an engine.

Mr Williams said the fuel cell had been a topic of speculation in the automobile industry for some time. However, the petrol engine was far from finished, and developments in petrol refining techniques would reduce the level of pollution from petrol engines to a low level.

NEW-MINISCOPE

THE REMARKABLE ANATOMY OF MINISCOPE...





Look how remarkable Miniscope really is. *Faster—easier to handle.* Allows easy access to confined areas with minimum risk of damage to miniature components. Remarkably versatile, it can be used for soldering work where the normal 75 watt 240 V. iron is used, or can be used on miniature components where minimum amount of heat is required.

SPEED: Five seconds from cold, thereafter instantaneous.
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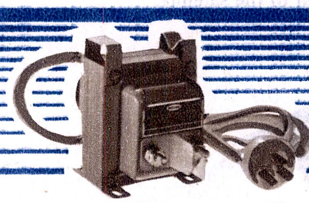
CONVENIENT OPERATION: Voltage range from 2.5 to 6.3 V. A.C. or D.C. or from 240 V. A.C. mains through a National Scope Transformer. The new model features a slotted nylon centre piece which is unbreakable and allows easy adjustment of switch lever travel.

Price still $5.28



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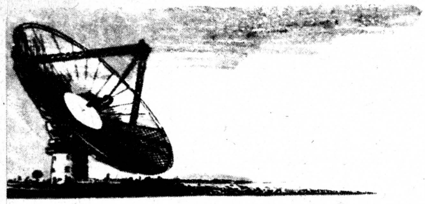


Airborne computer

A new type of airborne computer said to be lighter, smaller, cheaper and more reliable than any comparable equipment used for navigational computation has been developed in U.K. by the Marconi Company. It will control the navigation of an aircraft to any predetermined point on the face of the earth. The equipment, Type AD670, is completely solid state and substantially microminiaturised. The computer is a Digital Differential Analyser type (D.D.A.) and although it has a wired-in program it can be set for a number of applications such as navigation, and guidance, flight management or weapon aiming.

The D.D.A. type of computer uses about 50 per cent of the logic circuitry and 18 per cent of the memory capacity of a comparable general purpose computer. In the AD670, further savings in space and weight and an even greater reliability are achieved through extensive microminiaturisation. The flexibility of the general purpose type of computer allows changes of program to be made during flight, for example, from a navigation role to a fuel flow management role. However, Marconi's believe that, in practice, once a computer has been programmed for a specific purpose, it will carry out that function for the whole flight and for this a fixed, wired-in program is sufficient. If necessary, the AD670 can be easily re-programmed in the workshop between flights.

Better weather forecasts

Weather information of vital importance to Australia's primary industries, airlines, shipping, tourism, and the private citizen, will soon be processed here by a new twin computer centre. The Commonwealth Bureau of Meteorology will install the central computing facility in Melbourne, where a large IBM computer complex, costing approximately $4 million, will be linked by a communications system with meteorological data sources and information users throughout Australia and overseas.

The new centre will play an important role in the World Weather Watch, planned by the World Meteorological Organisation in response to a request of the United Nations General Assembly. It will have the responsibilities of a World Weather Centre, together with similar centres in Washington and Moscow, exchanging global weather data and charts.

To help Australia's weathermen in local weather forecasting, the computers will process, round the clock, data from nearly 1,000 surface reporting stations supplying meteorological observations gathered in the Australian area, the southern hemisphere and the tropical region. Using these data, the computer centre will assist in issuing forecasts — including warnings of weather conditions likely to endanger life and property — plot weather charts, compile lists of selected observations, carry out statistical processing and research calculations including mathematical modelling, and generally apply the latest principles of electronic data processing to the Bureau's principal functions.

Automatic tracking radar

A new radar, the "BEARN," has been developed by the Compagnie Francaise Thomson-Houston at Bagneux, France. the object of this latest French radar is automatic tracking of fast moving craft or missiles whether equipped with radar responders or not. With skin-return echo, its range is claimed to exceed 200 miles for a target moving at 12,000 m.p.h. or about 15 times the speed of sound. Where the object is fitted with a responder, the range exceeds 2,500 miles. The radar will be used to compute the path followed by a missile and locate the exact spot where it will drop.

Modernising banking

Data transmission trials are being conducted by Plessey Automation for an Australian trading bank. The company has installed a medium-speed tape data transmission system to link the bank's head office in the heart of Sydney with one of its suburban branches. The system is designed to allow much more rapid cheque clearing and current account processing than has been available in Australia before. The operation is in the pilot stage and is understood to be one of a number of recent developments in data transmission in Australia.

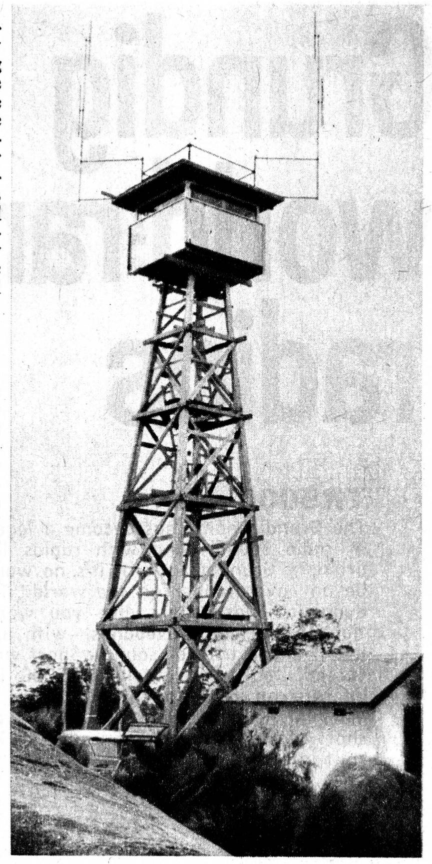
Considerable growth in data transmission has taken place overseas, particularly in the U.K. and the U.S.A. Modern requirements for rapid transfer of information from one computer to another can necessitate transmission rates up to 200,000 times as fast as the ordinary telegraph system can provide. The Post Office last year advised that it would make lines and connecting equipment available for lease to allow operation of privately-owned data transmission systems.

Robot translators

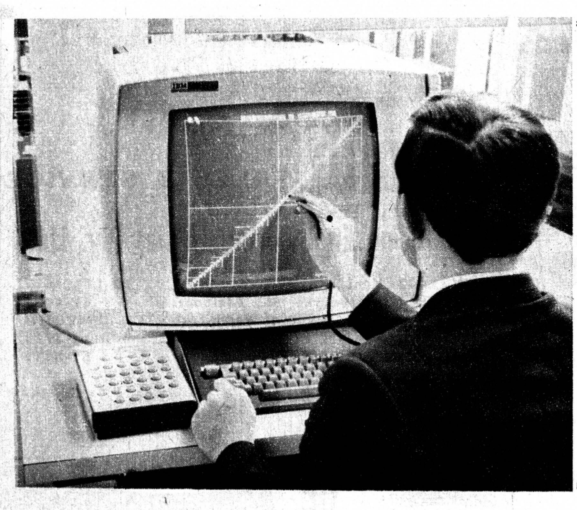
Pocket-size translating machines were a development of the future suggested by Sir Leon Bagrit, Chairman of Elliott-Automation Limited, in one of his Reith Lectures on "The Age of Automation," broadcast by the B.B.C., in which he surveyed the vast range of computer application.

Although the idea of a complete translating machine might sound a little fantastic at the moment, Sir Leon said: "We have already at our disposal means of converting human vocal sounds into numerical symbols. We also have some knowledge of how to convert numerical symbols into vocal sounds, so the time is not far away when the computer will be able to recognise the pattern of speech and to reproduce artificially a human voice. Once this stage is reached we shall be able to speak into a computer and get the sound translated into electronic symbols.

These symbols would not necessarily repeat the sound in English. They could repeat it in any other foreign language with which the sounds could be made compatible. So that it is quite reasonable to conceive a personal miniaturised translating machine which you would carry in your pocket and which would allow you to talk to a Chinese in English and allow him to reply in Chinese. But you would hear his reply in English. There would be limitations no doubt for a long time to come in the kind of vocabulary available and its size, and there would probably be technical hitches of various kinds, until perfection was ultimately reached."

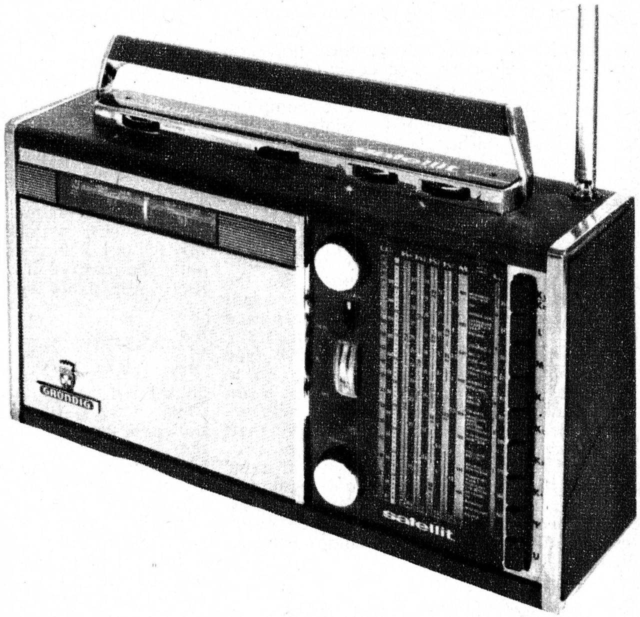


A network of VHF radiotelephone stations is used in the W.A. State forests to assist in the spotting and control of forest fires. Many of the stations are situated on spotting towers, as illustrated here, but in some areas radio posts are mounted directly on the giant Karri trees, which often reach a height of more than 200ft. The radio network employs a number of talk-through repeater stations to enable the Perth control centre to talk directly with any one of the widely scattered observation posts and a large fleet of radio-equipped vehicles operating in the thousands of square miles of forest. The radio equipment was supplied by Telecommunication Company of Australia Pty. Ltd.



Light screens have been installed at the Rolls-Royce plant in U.K. which enable engineers to communicate directly with computers. By using a light pen on the screen, an engineer can convey design information to a computer which then undertakes the stressing analysis and detailed design of engine components.

Grundig world-range radios



TR5000

The Grundig name has become a legend for quality in radio sound. And with radios like the extraordinary Grundig Sattelit, it's no wonder! You can be an eavesdropper on the world. Two Superphon dynamic loudspeakers give you world-wide reception on thirteen wavebands—with an unbelievable depth and clarity of sound. Short wave, FM, bandspread, too! The Satellit TR5000 is designed to operate on batteries or AC mains, and receives VHF/FM, long, medium and short wavebands. The short wave coverage ranges from 10 to 187 m., split into four bands.

Additionally, six bandspread short wave ranges are provided, shown on a separate scale with a rotating drum selector. The Satellit is fitted with 17 transistors and 11 diodes. It features a short wave fine tuning dial, automatic frequency control on FM, R.F. stage, a switchable ferrite aerial, a double extension telescopic aerial, a separate control for the bandspread short wave tuner, duplex drive on FM/AM, a tuning and battery indicator, and two multi-octave loudspeakers. The Satellit also has an illuminated tuning scale and separate bass and treble controls. Sockets are provided for headphones, external aerial and earth, car aerial, record player, tape recorder and external battery power supply.

The Satellit transistor 5000 has a handsome padded graphite case with chrome and satin silver trim. It measures 16" x 10" x 4¾".

TR3000

The Ocean Boy TR3000 is not just a transistor radio, it is a perfect piece of precision engineering. The whole world's your oyster with the Grundig TR3000. Choose a wavelength by pressing one of the nine buttons and using the fine tuning control. See visually when you are at the point of best reception by the tuning indicator (which doubles as battery indicator). Adjust the bass and treble tone controls and you're hearing a radio that's built for listening to, not straining at. The Ocean Boy has two loudspeakers, 13 transistors, 8 diodes and 2 rectifiers. Provides matchless listening on VHF/FM, long, medium and 4 short wavebands (10 to 185 m.). Output is up to 2 watts (R.M.S.).

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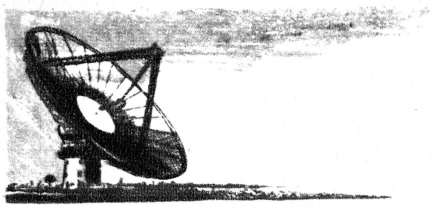
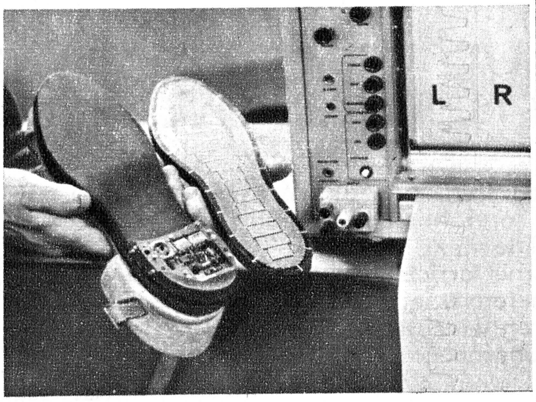


D.C.A. training aid

A Solartron radar simulator has been delivered to the D.C.A. Melbourne Training Facility for use in training future Air Traffic Controllers. The simulator provides 24 synthetic aircraft, each controlled by a "pilot" operating an aircraft control panel. The equipment works with normal radar PPI displays as used by D.C.A., so trainee controllers see realistic aircraft "paints" on their displays.

The heart of the equipment is a computer which continuously calculates the three-dimensional position of each aircraft simultaneously, in response to the speed, rate of climb, rate of turn and other signals fed to it by the aircraft control panels. "Exercise freeze" facilities are provided so that any particular traffic control situation can be held for analysis by instructional staff. The equipment incorporates the operating parameters for the present and future generations of aircraft, including the supersonic types to be introduced in the coming years.

Electronic sandals for measuring loads on the feet have been developed in U.K. In orthopaedics, there is a need for quantitative data on the degree of incapacitation in patients suffering from arthritic hips, and because direct hip-load measurements are impractical foot loading has been substituted. The device operates by translating pressure on the sole to a voltage reading which is recorded on a paper roll by a pen recorder each time the patient takes a step.



Portable welding transformer

A portable air-cooled transformer for light-medium and medium-heavy ferrous arc welding and brazing is now being produced in U.K. for machinery maintenance on shop floors, for the repair of agricultural implements and for site work generally. The transformer, which is cooled by induced air flow, is housed in a cabinet of 1/8in steel plate welded throughout and mounted on four castors. This is a single-phase machine which can be adapted for operation on one or two phases of a three-phase supply. The maximum welding current that can be used is 180 amps; the minimum 35 amps. The manufacturers are Ferrous Transformers Ltd., Church Road, Croydon, Surrey.

Versatile scintillation counter

A device, the M.K. II Universal Scintillation Counter, which can be adjusted to suit a great many routine radio-isotope tests employing Gamma-emitting isotopes such as I-131, Fe-59, Cr-51, Ca-47, Xe-133, has been developed by E. R. D. Engineering Co. Ltd., Kelpatrick Road, Cippenham, Slough, Bucks, U.K. When testing liquid samples, the assembly of the device need be only slightly altered to change from the assay, for example, of blood samples having a volume of 5-10mL, to the counting of large specimens (e.g., 24-hour urine collections in 2-litre bottle). Three basic arrangements can be made to suit different types of "in-vivo" counting, i.e., with live subjects. The first arrangement would suit, for example, liver function tests; the second, radiocardiography in adults; the third, radiocardiography in children and experimental animals.

Saving computer time

A new computer language that will cut time spent in technical information searches from hours or days down to minutes—or even seconds—has been developed by the Lockheed Missiles and Space Company. Completion of the new information retrieval language, known as DIALOG, was announced by the firm's Information Sciences group at the L.M.S.C. Palo Alto Research Laboratory in California. Lockheed's new language is an outgrowth of the need to provide quick access to literally millions of technical papers and files accumulated over the years by scientists and engineers—particularly in the aerospace industry.

Technical librarians in industries throughout the United States spend thousands of hours annually combing indices for references to technical information required by scientists and engineers. But using DIALOG, the same librarians could query a computer system—in layman's terms—and receive the references they need in a matter of minutes.

More CCTV for R.N.

Marconi television systems will be used for flight deck surveillance on all British aircraft-carriers, following orders placed by the U.K. Ministry of Defence (Navy). H.M.S. Eagle and H.M.S. Ark Royal are the last R.N. aircraft carriers to be fitted, making a total of 30 British and U.S. aircraft carriers now equipped with Marconi closed circuit systems.

The two British ships will each have a single closed-circuit television channel with the camera mounted on the carrier superstructure. The lens angle and direction of this can be adjusted by remote control from the control tower, where a television monitor displays pictures of the flight deck.

Inexpensive but accurate

Low priced decade capacitor boxes having accuracies exact enough for most applications involving test equipment, timing circuits and electric wave filters, in addition to the conventional radio frequency and audio-frequency applications, have been developed by Lionmount & Co. Ltd., Bellevue Road, New Southgate, London, N.11. There are six standard units which together cover the range of electro-static capacitance from 9pF to 111uF and incorporate capacitors of silvered mica or plastic having low power factors and high insulation resistance. Ceramic wafer switches are used to keep leakage and losses to a minimum.

A new line of simple superhets for home constructors—

The S meter and the knobs for AM-SSB, BFO and S meter Zero are not to be used at this stage.

The circuit opposite has been kept as simple, yet efficient as possible and should be easy to get going.

THE 67 ALL-WAVE THREE RECEIVER

In the June issue we presented the "67 All-Wave-Two," which we hoped would be the forerunner of a progressive series of all-wave receivers. The next step, the "67 All-Wave Three," is presented in this article. Unlike the All-Wave-Two, this one is a superheterodyne in about its simplest form and stripped of most refinements. It is planned to add to this unit in subsequent articles.

By Ian Pogson

Before proceeding with a description of this receiver, perhaps a few words of explanation would be in order, as to what we have in mind.

The plan is to finish up with a receiver having six valves in all. Planned line-up is a 6BL8 first mixer and oscillator, a 6BE6 amplifier and converter, 2 x 6EH7 IF amplifiers, with back-to-back IF transformers, a 6BE6 product detector and BFO and a 6GW8 audio amplifier. An S-meter is also incorporated in the complete receiver. This is the plan and it is possible that there may be modifications in the process of development, but it will indicate the direction in which we are heading.

Having decided on the general plan, it was then decided to lay out a chassis and front panel to suit a six valve receiver. Then we took a careful look at the proposed circuit for the six valve receiver and started to prune it down to the bare essentials. The result is the 67 All-Wave-Three, as featured here.

As will be apparent from the chassis photographs, the three valve receiver is built on the chassis and front panel which will ultimately accommodate the six valve receiver, and this leaves a number of unused holes on the chassis and panel. Our next proposed move is to provide double conversion for the two higher frequency bands, leaving the broadcast and the first short-wave band operating with single conversion. Having added the valve and other components for this addition, we then will have the "67 All-Wave-Four."

After this move, the next logical step appears to be the addition of a product detector and BFO, using one extra valve. This will allow the reception of Morse Code and SSB signals.

Finally, we proposed to add an extra IF amplifier stage. This move will be accompanied by the addition of back-to-back IF transformers, to improve selectivity as well as gain. Somewhere along the line, an S-meter will be added. The final design should be capable of quite a high degree of performance and should satisfy most short-wave listeners.

The reasoning behind this approach to a series of receivers, is that one may start off with the three valve version and add to it as time goes on. This can be done as required and it is virtually just a matter of adding the extra parts, with possible minor alterations to adapt to the new arrangement.

There is another advantage: The arrangement is so flexible that you may build up the receiver with the combination of facilities which may best suit your needs, leaving out any which you consider superfluous. For instance, if you are not interested in SSB reception, or Morse Code, you could leave out the product detector and BFO. On the other hand, you may wish to have an S-meter on only the four valve version. In short, you may "roll your own" just to your liking.

An alternative to the idea of using a common chassis and panel for the series, would be to have a separate chassis and panel for each receiver. We ruled this out, since it permits very little flexibility. Furthermore, manufacturers and stockists of metalwork would have to carry extra stock, which is uneconomical and reflected in the final cost.

Having outlined our plans, we can turn our attention to the circuit of the three valve version. The first stage uses a 6BL8, the pentode section as the mixer, with the triode section for the local oscillator. There are four sets of switched coils, covering the range fully, from the broadcast band to 30MHz. More will be said about the coils and switching a little later on.

The mixer-oscillator converts the incoming signal to an IF of 455KHz. This is passed through the first IF transformer, to the 6EH7 IF amplifier. The amplified signal then passes through the second IF transformer to an OA91 or similar diode detector. Included in the detector circuit, is a simple series type noise limiter, which is left permanently in circuit.

The recovered audio from the detector then passes on the audio stages via a 500K volume control. The audio amplifier is quite conventional, using a 6GW8 triode pentode. The output transformer is such that it provides a 7000 ohm load to the output stage, when operating into the correct voice coil impedance.

Automatic gain control is derived from the plate circuit of the 6EH7 IF amplifier. AGC is then fed back to the control grids of the 6EH7 and the 6BL8 pentode section. The RF gain control is closely associated with the AGC system.

The power supply is a voltage doubler type, which is in common use these days. This is followed by an inductance-capacitance filter. A "back bias" arrange-

ment is provided for the RF gain control and its related circuits.

Having covered the circuit in broad outline, let us now have a look at the details. Perhaps one of the most difficult problems to solve in a full coverage receiver of this type, is the question as to what coils to use and needless to say, we had to face this one. Fortunately, just at the right time, Aegis Pty. Ltd., of Melbourne came up with a novel idea and which appeared to be worth investigating.

Basically, the idea is what could be called "instant short-wave coils." Three different sizes of coils are ready wound, each including a primary and secondary winding. The start of each winding is soldered to its terminating lug. More than enough turns are wound on the former and the two finishes are loosely terminated on the appropriate lugs. The idea is to wind off the turns which are not needed and then terminate the ends, resulting in the required coil.

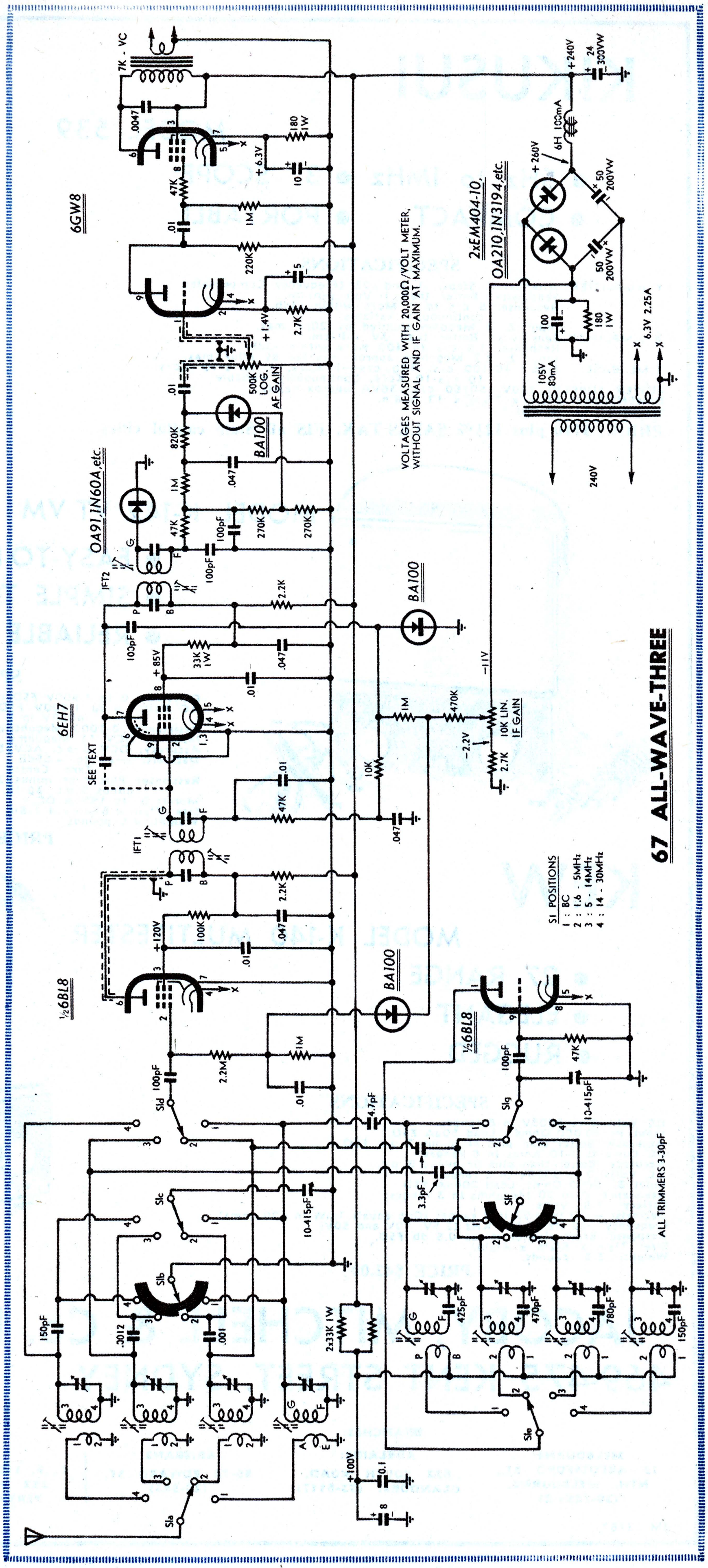
These basic coils can be modified so that they become an "aerial" coil, an "Rf" coil, or an "oscillator" coil, according to the need at hand. The three different sizes of coils differ from each other in that they have a graduated number of turns. This permits the use of the right basic coil for the frequency range to be covered. This selection makes it possible to provide suitable coils for all functions that will cover from about 1.5MHz to 30MHz.

Physically, the coil assembly consists of several parts: (1) An inner tube, which is in fact a 7mm former, with a tuning slug, with a spire clip at one end for mounting to the chassis; (2) An outer polystyrene former, ½in diameter and 1in long, which has the actual coils wound on it; (3) A collar, with four lugs for terminations, fitted to one end of the coil former. This collar in turn, is a push fit over the inner tube, resulting in a neat assembly. Elsewhere in this issue is an article which deals at some length with these coils and their application.

The coil switching involves the use of three switch banks. The bank at each end of the assembly is a 2-pole, 4-position, with a common shorting plate. The centre bank is a 2-pole, 4-position, without shorting plate. The bank nearest the clicker plate switches the primary and secondary of the aerial coils. The bank at the other end switches the primary and secondary of the oscillator coil. One pole of the centre bank is used as an auxiliary switch for the grid circuit of the aerial coil. The other pole of this section will be used when the receiver is made into a double conversion unit.

The shorting plates are necessary to avoid unwanted coupling between coils, with consequent "suckout" and degradation of performance. The shorting plate for the aerial coils is connected to earth, but the shorting plate for the oscillator coils must be left floating, otherwise the oscillator HT supply would be shorted to earth. The auxiliary switching in the signal grid circuit is needed because capacitors are introduced in series with the tuning capacitor, on the short-wave bands, to limit the coverage of each range.

Small capacitors of 3.3 and 4.7pF are used on all ranges except the highest frequency range. These capacitors are needed to give the right amount of oscillator injection into the mixer grid. There is sufficient injection on the



67 ALL-WAVE-THREE

KIKUSUI

MODEL 539

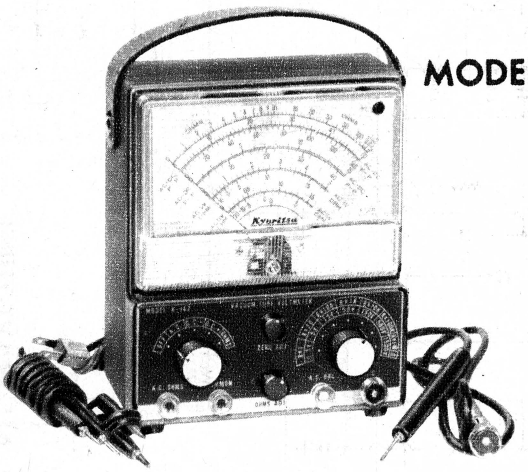
- 5Hz to 1MHz • 3" 'SCOPE
- COMPACT • PORTABLE

SPECIFICATIONS

Y AMPLIFIER: Attenuator: Steps. .1 and .02 (Frequency Compensated
Sensitivity: Better than 1 Volt p-p/cm.
Response: 5 c/s to 1 Mc/s within -3db.
continuously variable.
Input Z: 1 Megohm shunted by 20pF max.
X AMPLIFIER: Sensitivity: Better than 3V p-P/cm.
Response: 1.5 c/s to 400 Kc/s within -3db.
Input 2: 2.2 Megohms approx. shunted by 60pF max.
TIME BASE: Freq.: 10-100 c/s; 100 c/s—1 Kc/s; 1 Kc/s-10 Kc/s;
10 c/s-10 Kc/s. Continuously Variable.
POWER SUPPLY: 240V: 50/60 c/s: 36VA approximately.
DIMENSIONS: $4\frac{1}{4}$in x $7\frac{3}{4}$in x 13 5/8in.
WEIGHT: 11 pounds.

PRICE: $110 plus 12½% SALES TAX. FIS all State capital cities.

KEW



MODEL K-142 VT VM

- EASY-TO-READ 6" SCALE
- SIMPLE TO USE
- RELIABLE

SPECIFICATIONS

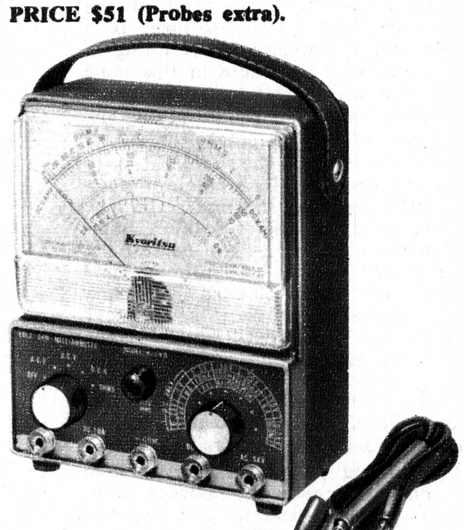
DC Volts: 0 to 1,500V FSD in 7 ranges (15KV or 30KV, using HV probe).
AC Volts: 0 to 1,500V FSD (sine-wave) in 7 ranges (Peak to Peak) 0 to 4000V in 7 ranges.
Resistance: 0-1000 Megohoms in 7 ranges.
Input R: DCV 11 Megohms (1 Megohm in probe).
Accuracy: DCV 3 p.c. ACV 5 p.c., Ohms 3 p.c. FSD.
Decibels: —20 to +65dB.
Zero Centre for adjusting FM detectors.
Response: Plus over minus 3 p.c., 50Hz to 500KHz. (AF/RF): Plus or minus 5 p.c. 30 Hz to 1.5MHz; 10 p.c. 15Hz to 10MHz.
Meter: 0 to 195uA DC.
Size: $7\frac{1}{2}$in x $6\frac{3}{4}$in x 4 1-8in.
Weight: 4.5 pounds.

PRICE $51 (Probes extra).

KEW

MODEL K-140 MULTITESTER

- 27 RANGE
- ELEGANT
- RUGGED



SPECIFICATIONS

DC Volts: 0 to 5000V in 8 ranges.
Input R: 20,000 Ohms. Load 50uA FSD.
Accuracy: Better than plus or minus 3 p.c. FSD.
DC Current: 0-10 Amps in 6 ranges.
Accuracy: Better than plus or minus 3 p.c.
AC Volts: 0 to 5000V in 6 ranges.
Input B: 5000 Ohms, Load 200uA FSD.
Resistance: 0 to 20 Megohms in 3 ranges.
Battery: 7.5 Volts.
Decibels: —20 to +50 in 4 ranges (Odb equals 1mW in 600 ohms).
Frequency: 10 Hz to 100 KHz (2.5V, 10V and 50V).
Response: Error plus or minus 0.5 db FSD.
Size: $7\frac{1}{2}$in x $6\frac{3}{4}$in x $4\frac{1}{2}$in.
Weight: 3.3 pounds.

PRICE $42.00

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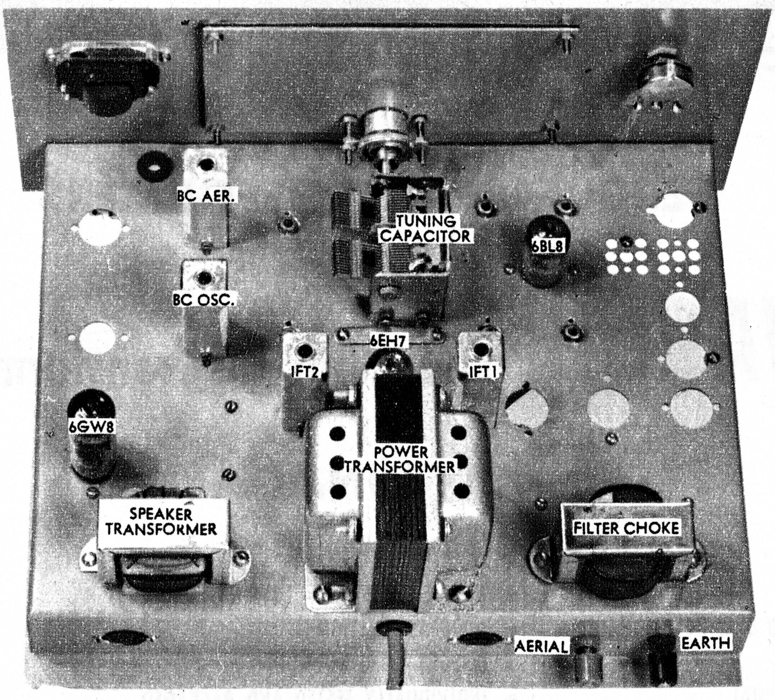

This top view will serve to identify most of the major components. Note the vacant holes for future enlargement into a receiver with additional facilities and improved performance. These additions will be easy to make.

highest frequency range, via stray capacitance.

The pentode section of the 6BL8 is operated in a conventional manner as a mixer. It is a highly efficient mixer and is less noisy than the more conventional pentagrid mixers. This is important to us, as we are not using an RF stage, in the interests of economy.

The IF amplifier is relatively conventional. However, two points are worth noting. In common with the mixer, the cathode is connected directly to earth, obviating the need for both a resistor and bypass capacitor. In addition, by making a short, direct connection to earth, the likelihood of instability is reduced. Bias is obtained by another method and will be dealt with shortly. We have introduced a small amount of positive feedback. from plate to grid of the IF amplifier. This is strictly controlled and is not sufficient to make the stage oscillate. However, by introducing a judicious amount of feedback, it is possible to increase the gain and improve the selectivitv—both important matters in such a simple receiver.

The feedback is shown as a dotted capacitor in the circuit diagram. The "capacitor" consists simply of a piece of hookup wire, about 1½in long. One end of the wire is soldered to the plate lug of the socket. The wire is bent over the centre shield of the socket and "looks" at the grid lug. The wire is bent and moved close enough to the grid lug so that the requisite amount of feedback is obtained. This adjustment will be covered in the alignment details.

IF signal is taken from the plate of the IF amplifier and rectified for AGC. Taking the signal from the plate, rather than from the grid connection of the following IF transformer, gives a superior AGC characteristic. The AGC voltage developed is fed back into the control grid of both the IF amplifier and the mixer.

It will be noted that the AGC voltage to the mixer grid is "gated" through a BA100 silicon diode. This is necessary to prevent any negative voltage, which appears on the mixer grid, as a result of oscillator injection, from being fed back into the AGC line.

The AGC load resistor, instead of being returned to earth, is taken to the rotor of the IF gain control. One end of this control is taken to the -11 volts from the back-bias resistor in the power supply. The other end of the gain control is connected to earth, via a 2.7K resistor. At the junction of this resistor and the gain control, is about -2.2 volts. With the gain control at maximum and the rotor at this end of the potentiometer, this minimum voltage is fed into the AGC line and so acts as bias for the mixer and the IF amplifier. Moving the rotor of the IF gain control toward the other end progressively feeds a higher negative voltage into the AGC line and so acts as a manual gain control.

This type of manual gain control was used in the Deltahet receiver and it is a very effective method, particularly when an S-meter is used on the receiver. It is possible to introduce a certain amount of manual control on a signal, without affecting the S-meter reading. More will be said about this in a later article.

The power supply needs a certain amount of explanation. The transformer which we used is an A and R, type 2062. This is rated at 80mA and has secondary voltage taps at 115 and 105 volts. We used the 105 volt tap, which gives the voltages as shown on the circuit.

The two 50uF voltage doubler capacitors which we used are only rated at 150 volts working. Using the 105 volt tap on the transformer, these capacitors are run just inside their ratings and the rating is quite in order.

An alternative transformer which is also suitable is the Ferguson type PVD100, also rated at 80mA. The secondary voltages on this transformer are 120, 110 and 100. Either the 100 volt or the 110 volt taps may be used. However, a word of caution is needed if you select the 110 volt tap. This will result in a voltage across the 50uF voltage doubler capacitors which exceeds 150 volts. In these circumstances, capacitors of a higher voltage rating, such as 200 volts working, will be required

No doubt you will be wondering why a transformer rated at 80mA has been specified, when it is obvious that the drain is well below this figure. Firstly, 80mA is the lowest rating of voltage doubler transformer which is readily available. Secondly, when extra valves are added in the future, extra current drain will be imposed on the power supply.

The filter choke specified is also capable of a higher current than necessary. Again, this is a small unit and is readily available. Before leaving the power supply, we have brought the heater and HT supply to a miniature 4-pin socket on the rear skirt of the chassis. This may be used for ancillary equipment, such as a converter.

So much for the circuit details. Now we can turn our attention to the mechanical details. The photographs show clearly how the unit is constructed. The chassis measures 12in x 9in x 2in, with a front panel measuring 13in x 7in.

There are many vacant holes in the chassis, on this version of the receiver and we have deliberately left them that way. This highlights the space that has been provided for expansion into a larger version if and when required. On the other hand, we have filled up the holes on the front panel which are not being used at present. The holes referred to, are for the AM-SSB switch, BFO adjustment, S-Meter and S-Meter

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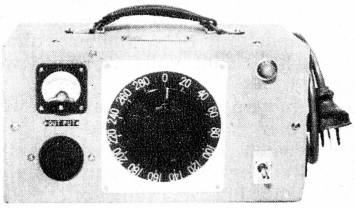

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SD285	1,000	5
SD288.2	2,000	8.2
SD2812.5	3,000	12.5
SD2816.6	4,000	16.6
SD2820.1	5,000	20.1
SD2825.06	6,000	25.06
SD2829.19	7,000	29.19
SD2833.36	8,000	33.36
SD2841.70	10,000	41.7

MINIATURE TYPE: PH—panel type; SD—stand type

MODEL	WATTS	AMPS.
PH280.5	50	0.25
PH281	100	0.5
PH281.5	150	0.72
SD280.5	50	0.25
SD281	100	0.5
SD281.5	150	0.72

PORTABLE TYPE: With fuse, voltmeter, etc.

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C285	1,000	5.0
C288.2	2,000	8.2

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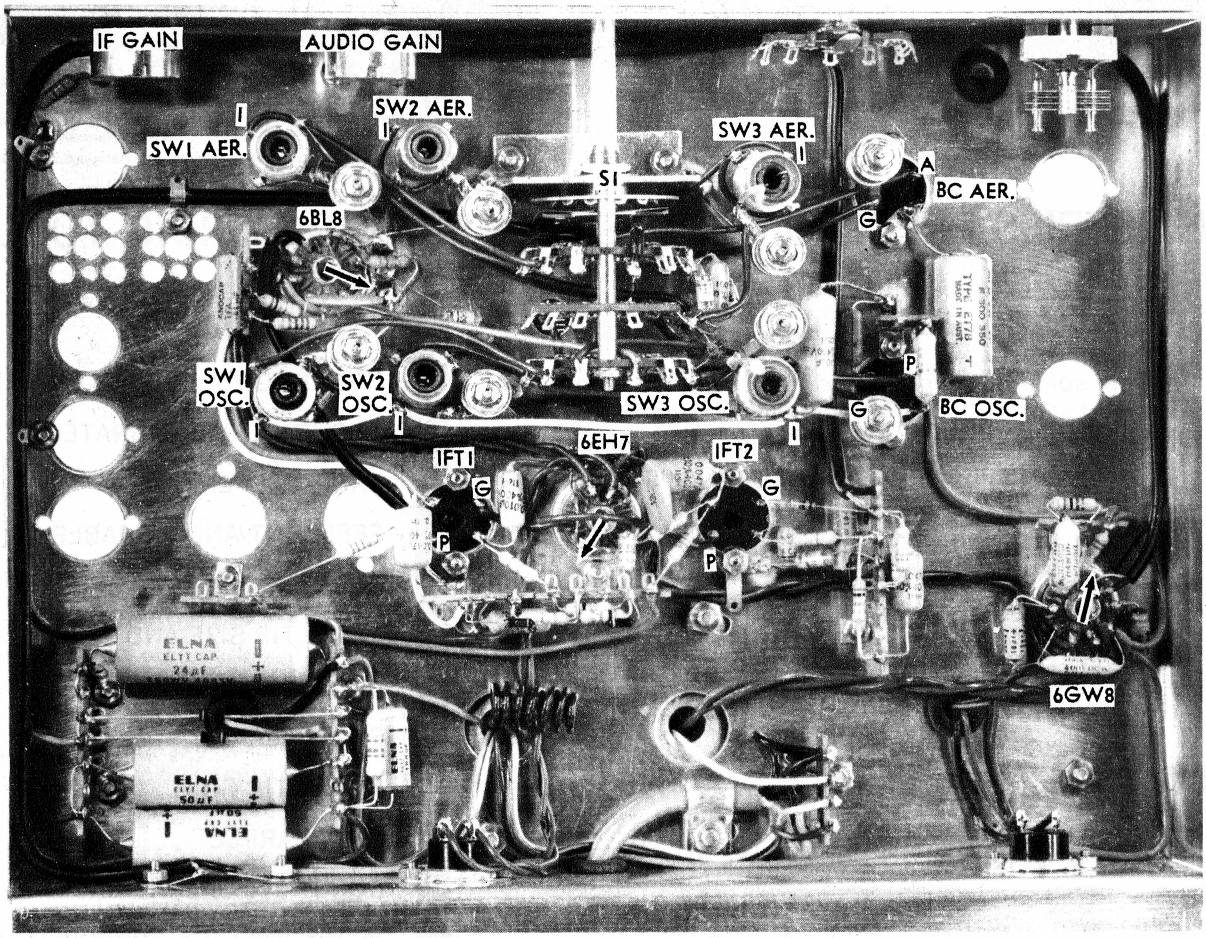


The disposition of the coils, trimmers and switch can be seen with relation to each other. The aerial coils are nearest the front skirt, with the oscillator coils near the centre. The highest frequency coils are to the right of the switch, with the next range on the other side.

Zero. This has been done to give an idea of the appearance of the full-size receiver. Individual builders may leave the holes open at this stage.

The chassis and panel layouts have been worked out so that an efficient arrangement was achieved, together with a pleasing appearance and ease of operation. The most vital part of the layout concerns the coils and the switch, in relation to each other and to other closely associated components. Cramping has been avoided and there should be no difficulty in duplicating the original.

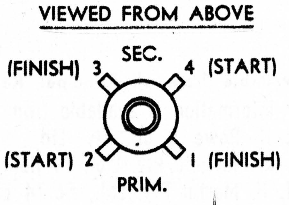
The wave-change switch is mounted on a special bracket and it is fixed to the chassis with the same two screws which fix the front foot of the tuning capacitor. With this arrangement, it will be noted that the hole in the bracket for the switch bush is off centre with respect to the bracket.

Following on from the coils and the 6BL8 mixer-oscillator, the IF strip is immediately behind. In the same line, is the detector and noise limiter wiring and this feeds across towards one back corner, to the audio amplifier and the output transformer. The power supply, both above and below chassis, occupies the rest of the space along the rear of the chassis.

Care has been taken with the three-valve version, so that all major components will stay in their present positions, even when all the extra facilities and stages have been added. Thus, the various switched coils of the front end, the audio circuits and the power supply, will remain in the same positions and substantially as they are at present.

The detector and noise limiter will not be changed. However, although the 6EH7 IF amplifier will also remain in its present position, it will become the second IF amplifier. At the present time, there is a relatively long lead from the plate of the 6BL8 mixer, to the IF transformer which couples into the IF amplifier. This lead, which is shielded for stability reasons, will be considerably shortened in later versions.

SHORT WAVE COIL TERMINATIONS
VIEWED FROM ABOVE



This diagram of the coil terminations should be carefully followed, in relation to the circuit. This applies particularly to the oscillator coils.

One vital part of the "mechanics" has not been touched on so far. We refer to the dial. This is a never-ending problem but we were faced with the same sort of need when we developed the SSB Transmitter. The dial which we made up for that project turned out to be very satisfactory and so we were encouraged to adopt a similar approach for this receiver. The main difference between the two dials is that this one is somewhat larger.

The basic movement is the planetary dual-ratio unit, made by Jackson Bros., and distributed in Australia by Messrs Watkin Wynne. A backing plate, 6 5/16-in x 3¼in, was made from 16-gauge aluminium sheet.

The dial scale is the same size as the backing plate and in our case, we used a piece of Formica board, which is about 1/16in thick; one face is finished in matt white. All lines are drawn in, using drawing instruments and Indian ink. Photographic reproductions of the scale will be available through the Information Service, at 50c each. The alternative is to do the whole job yourself, along with the calibration, which will be discussed later.

An escutcheon adds an appropriate finishing touch to the assembly and we made one up from another piece of 16-gauge aluminium. The outside dimensions are the same as the backing plate. The inside dimensions are 5 11/16 x 3 1/8in. These latter dimensions correspond with the cut-out in the front panel, with four mounting holes also corresponding with holes in the front panel and backing plate. The escutcheon was given a coat of glossy black enamel

and the results are very pleasing. Although we have not done it, a coat of black paint on the screw heads is another good finishing touch.

So much for the dial assembly, except for the pointer. We solved this one for the transmitter by using a meter pointer. However, these are not readily obtainable and in this case, it is doubtful if it would be possible to get one long enough. And so we got to work and made one out of a piece of 16-gauge copper wire. This is how we did it.

Take a piece of tinned copper wire, about 2½in long. This is hammered flat, leaving about ¼in still round at one end. This process calls for a little time and patience. A hammer with a good smooth face and a hard flat surface, such as part of a vyce, are the tools to begin with. Keep hammering, not too hard, until a reasonably flat surface is obtained on one side. Then turn the wire over and proceed to treat it in the same way. Do not worry overmuch, if the flattened wire assumes the shape of a banana. This can be straightened as the job proceeds.

Having done what could reasonably be considered as a good job up to this point, there will be undulations due to uneven hammering. These are removed by carefully filing both flat faces. As this proceeds, careful inspection will dictate what should be done to make the finishing touches. When you are satisfied and the pointer is straight once again, solder the round end to a small solder lug and then give the pointer a coat of black paint. The hole in the lug is used to fix the pointer to the movement, with one of the two screws supplied.

Although we did not fit a sheet of perspex over the dial, some builders may prefer to do so. A piece may be cut to the same outside dimensions as the escutcheon. The perspex may then be interposed between the escutcheon and the front panel.

Assembly of the dial unit is quite simple but it is desirable to do it in a logical sequence. The movement is fixed to the back plate with two screws through the holes adjacent to the 13/16in hole. The lugs of the movement have to be spaced behind the back plate by about 9/16in. Suitable brass spacers can be used but this is not really necessary. We simply used brass screws, ¾in long. Six nuts are then used to give the right amount of spacing. This method has the advantage in that fine adjustments can be made to the spacing.

The backing plate is immediately behind the scale and the distance between the scale face and the back of the panel will need to be between 1/8in and 3/16in, according to space desired between the pointer and scale. One nut used as a spacer may be just insufficient and two nuts may give too much spacing. A combination of one nut and one or more washers will give the desired spacing.

Push the four screws through the corners of the escutcheon and include the perspex if used. The screws are then passed through the corresponding holes in the front panel. Run a nut (with the washers) on to each screw. The nuts should not be tightened at this stage. Offer the back plate assembly over the four screws and tighten the nuts. Four more nuts behind the back plate hold the complete dial in place. Screw the pointer to the movement.

PARTS LIST

1 Chassis, 12in x 9in x 2in.
1 Front Panel, 13in x 7in.
1 Cabinet to suit (if required).
1 Dual-ratio dial movement (see text for details).
1 Switch 2 wafers 2-pole 4-position with shorting plates, 1 wafer 2-pole 4-position.
1 Variable capacitor, 2-gang 10-415pF.
1 Power transformer, 105-110V 80mA, 6.3V 2.35A.
1 Speaker transformer 7K to voice coil.
1 Filter choke, 6H 100mA.
1 Coil, broadcast aerial.
1 Coil, broadcast oscillator.
1 Coil, 1.6-5MHz aerial (see text).
1 Coil, 1.6-5MHz oscillator (see text).
1 Coil 5-14MHz aerial (see text).
1 Coil, 5-14MHz oscillator (see text).
1 Coil, 14-30MHz aerial (see text).
1 Coil, 14-30MHz oscillator (see text).
2 IF transformers, 455KHz.
2 Valve sockets, 9-pin.
1 Valve socket, 7-pin.
1 Valve, 6BL8.
1 Valve, 6EH7.
1 Valve, 6GW8.
1 Socket, 2-pin miniature.
1 Socket, 4-pin miniature.
2 Terminals, one red, one black.
1 Potentiometer, 500K log.
1 Potentiometer, 10K lin.
2 Diodes, EM404-10, OA210, 1N3194.
2 Diodes, BA100.
1 Diode, OA91, 1N6OA.
1 8-tag strip, with two mounting feet.
2 7-tag strips, with two mounting feet.
1 5-tag strip.
3 4-tag strips.
2 3-tag strips.
1 2-tag strip.
6 Knobs.

RESISTORS
(½W unless specified)

2	180 ohms 1W	1	220K
2	2.2K	1	820K
2	2.7K	4	1M
1	10K	1	2.2M
3	33K 1W	2	270K
4	47K	1	470K
1	100K		

CAPACITORS

2 3.3pF NPO ceramic.
1 4.7pF NPO ceramic.
5 100pF plastic.
2 150pF plastic.
1 425pF mica padder.
1 470pF plastic.
1 780pF plastic (two 390pF in parallel).
1 .001uF 160V plastic.
1 .0012uF 160V plastic.
1 .0047uF 400V plastic.
3 .01uF 160V plastic.
1 .01uF 400V plastic.
2 .01uF 400V ceramic.
2 .047uF 160V plastic.
2 .047uF 400V plastic.
1 0.1uF 400V plastic.
1 5uF 3VW electro.
1 8uF 300VW electro.
1 10uF 12VW electro.
1 24uF 300VW electro.
2 50uF 200VW electros.

SUNDRIES

Power flex and plug, cable clamp, solder lugs, hookup wire, shielded cable, screws, nuts, solder, rubber grommets, etc.

The dial which results, is one which is capable of smooth and fine control over tuning. This can be even improved upon by the simple expedient of using a very large knob, which helps the vernier action. Note that this dial assembly information is placed out of the general assembly sequence, to keep the dial information together.

Before proceeding with the general assembly, it would be a good idea to get the short-wave aerial and oscillator coils ready. We will assume that you have two each of the Aegis types RFT2, RFT5 and RFT10. All the information needed is given in the coil table.

The process is quite easy but just a few pointers may be helpful. When removing turns, particularly with the fine wire, care should be taken to do it gently, to avoid breaking the wire. When the requisite number of turns have been removed, cut off the excess wire and terminate the end by soldering to the appropriate lug. In most cases, there will be sufficient sealing compound on the windings to hold the wire in place. In the case of the RFT10 coils, it is wise to put a dab of cellulose or other adhesive on the coil, to prevent unwinding and general movement of the turns. A diagram shows the terminations which are numbered and this correlates with the circuit diagram.

By tackling the assembly in some logical order, the job is made easier and quicker. Fit three rubber grommets, one each for the power cord, the filter choke and speaker transformer. The valve sockets should be orientated with the gap pointing in the direction as shown on the underneath picture. A 4-tag strip is mounted under one of the screws for the 6BL8 valve socket. A 5-tag strip is fixed under one of the screws for the 6EH7 valve socket, with a 3-tag strip next to the 6GW8 valve socket.

Mount the tuning gang, together with the switch bracket and put a solder lug under each of the four nuts. Then follow the broadcast aerial and oscillator coils and the IF transformers. Fix a 2-tag strip adjacent to the oscillator coil. Fit the two sockets and two terminals to the back skirt of the chassis.

Mount the power transformer, output transformer and filter choke. Fix a 4-tag strip under one screw of the output transformer. Fix a cable clamp under the power transformer screw, nearest the rubber grommet. Diametically opposite, fix a 4-tag strip under the power transformer screw. This strip should line up with the strip next to the IF valve socket.

Under each screw holding the filter choke, one foot of a 7-tag strip is fixed. Separate screws are needed for the other ends. An 8 tag strip is mounted between the second IF transformer and the audio amplifier. A 3-tag strip is also needed near the input of the first IF transformer.

The short-wave coils are about all that are left at this stage. They should

be carefully placed in the positions as indicated in the picture and with due regard to short leads. The coils are held to the chassis with spire clips; if the metal is too thick to take them, it may be necessary to countersink the holes slightly at the top of the chassis. The countersink should only be deep enough to allow the clip to spring into place.

The components should now be mounted on the front panel. The dial has been dealt with before and the other components need no comment, except that the gain controls are used to fix the panel to the chassis. If you do not fit the AM-SSB switch and the BFO control, it would be wise to fit at least one bush or a dummy control in either of the vacant holes, to stabilise the front panel at this end.

The job of wiring is tackled in the usual way. Terminate the flying leads from the transformers and the filter choke. This gets them out of the way and so makes the deck clear for the rest of the wiring. You will notice in the picture of the under-chassis wiring, that there is a "coil" underneath the power transformer. This is an unused tap on the transformer secondary. The bared end was cut off and the wire coiled up and placed so as not to allow any short circuit.

Run the heater wiring to the three valve sockets and the outlet socket on the back skirt of the chassis. We only earthed one side of the supply at one point, the earth connection being at the outlet socket. If you do not wire in this socket, the supply could be earthed at the 6GW8 valve socket.

Wire up the power supply, audio amplifier, detector and IF amplifier, in that order. The usual care should be taken to keep leads short and make the wiring generally neat. Be careful not to overheat any of the components while soldering. Liberal use can be made of solder lugs, at strategic points for earth connections. They may also be used as clamps to hold down some of the wiring and so add to the neat appearance.

Before proceeding with the coil and switch wiring, finish off as much of the wiring around the 6BL8 socket as possible. The wiring around the switch should not be rushed. It should be carefully studied so that wires and components are placed in logical order. It can be most annoying to find that you have to remove some of your good work, to fit something that has been forgotten!

The plate lead from pin 6 of the 6BL8, to the first IF transformer, must be run in shielded lead, earthed only at the IF transformer end. Leads to and from the AF gain control are also run in the same type of shielded lead.

We provided earth points for the broadcast band components on lugs under the aerial and oscillator coil mounting screws. Earth points for the 1.6 5.0MHz components are to lugs under the 6BL8 socket screws. Lugs for the 5.0-14MHz components are those under the adjacent nuts for the tuning gang. Finally, the lugs under the other two nuts holding the tuning gang, are used for the earth points of the 14-30MHz range of components.

The trimmers for all the coils are of the Philips concentric type. These should be mounted as firmly as possible in all cases, especially those on the oscillator coils. We connected ours directly to the respective coils, running stout tinned

SHORT-WAVE COIL INFORMATION

1.6-5.0MHz. Use Aegis type No. RFT2.

Aerial:	*Prim.*	*Remove 30 turns. This leaves 10 turns.*
	Sec.	*Remove 18 turns. This leaves 62 turns.*
Osc.:	*Prim.*	*Remove 32 turns. This leaves 8 turns.*
	Sec.	*Remove 25 turns. This leaves 55 turns.*

5.0-14.0MHz. Use Aegis type No. RFT5.

Aerial:	*Prim.*	*Remove 7 turns. This leaves 5 turns.*
	Sec.	*Remove 2 turns. This leaves 22 turns.*
Osc.:	*Prim.*	*Remove 8 turns. This leaves 4 turns.*
	Sec.	*Remove 5 turns. This leaves 19 turns.*

14.0-30.0MHz. Use Aegis type No. RFT10.

Aerial:	*Prim.*	*Remove 5 turns. This leaves 2 turns.*
	Sec.	*Remove 4 turns. This leaves 10 turns.*
Osc.:	*Same as for aerial coil.*	

copper wire to the earth lug where necessary.

Having completed the wiring, make a thorough check and be sure that there are no errors. The usual check for short circuits on the HT line should also be made. Having satisfied yourself that all is in order, switch on and, assuming that there are no signs of distress, it is a good idea to make some voltage checks. The important voltages are given on the circuit diagram.

Assuming that all is well, we can proceed with the alignment. Close the tuning gang fully and set the dial pointer so that it is on the horizontal line of the dial. Set the Band switch to "broadcast." Inject 455KHz from a signal generator into the grid (pin 2) of the 6BL8. Keep the generator to the lowest level consistent with sufficient signal. Adjust the four slugs in the IF transformers for maximum audio level. This can be done by ear or more accurately if an output meter is available.

Now set the dial pointer to 600KHz and inject a signal from the generator into the aerial terminal, at this frequency. Adjust the slug in the oscillator coil for maximum response; then adjust the aerial coil slug for maximum. Remember to keep the output from the generator down to a reasonably low level. Now set the dial pointer to say, 1400KHz. Feed a signal in from the generator at this frequency. Adjust the oscillator coil trimmer for maximum response. Repeat for the aerial coil trimmer. Go over this procedure again at 600KHz and touch up the slugs. Then check the trimmers at 1400KHz and make any adjustment that may be needed.

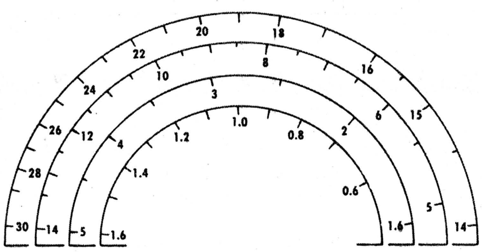
Switch progressively to each of the short wave bands. Set the dial pointer toward the low and high frequency ends of the bands, corresponding approximately with those already used for the broadcast band. Align at these points, using the same techniques as before.

One point should be watched, however, when aligning at frequencies above, say, 5MHz. Care must be taken to ensure that you are on the correct frequency and not on the "image." This can be checked by tuning the signal generator higher in frequency by 910-KHz. If this signal is heard in the receiver, then you are on the correct frequency. If not, you are on the image and you must go back and reset the oscillator slug or trimmer to the correct frequency. This is a characteristic of single conversion receivers when tuned to the higher frequencies. It is avoided by the double conversion technique, which will be dealt with in a later article.

Having completed the alignment, we can improve the sensitivity and selectivity, by introducing a small amount of feedback to the IF amplifier. Take a piece of hookup wire about 1½in long and solder one end to the plate, pin 7, of the 6EH7 valve. Now bend the free end over the top of the centre shield spigot of the valve socket, so that it comes within about 3/8in of the grid, pin 2. The amount of feedback can be closely controlled by moving the wire a little closer to, or further away from pin 2. It is possible to make the stage oscillate, but this is not the requirement. Just how close it is adjusted near to oscillation, depends upon personal choice.

You will notice that, as the feedback is increased, the sensitivity and selectivity will be noticeably improved. However, if set too close to oscillation, the performance may be erratic and this should be avoided.

After completing this adjustment, it is wise to check the alignment of the primary of the second IF transformer. At most, it will only need a touch. And so the project is complete as far as the three valve version is concerned. Whether you intend to add to it later on or not, you will have a lot of fun with this receiver. Next month, we hope to describe a four valve double-conversion unit.



This small picture of the prototype dial scale will indicate the coverage and frequency law to be expected.

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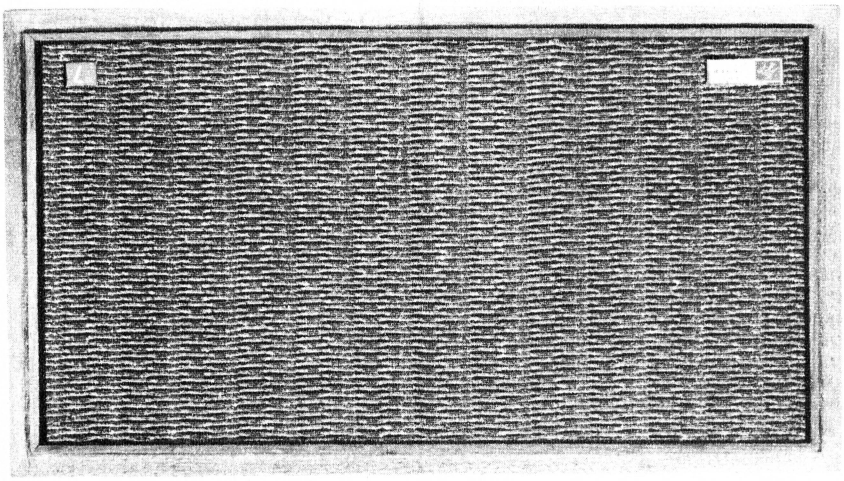

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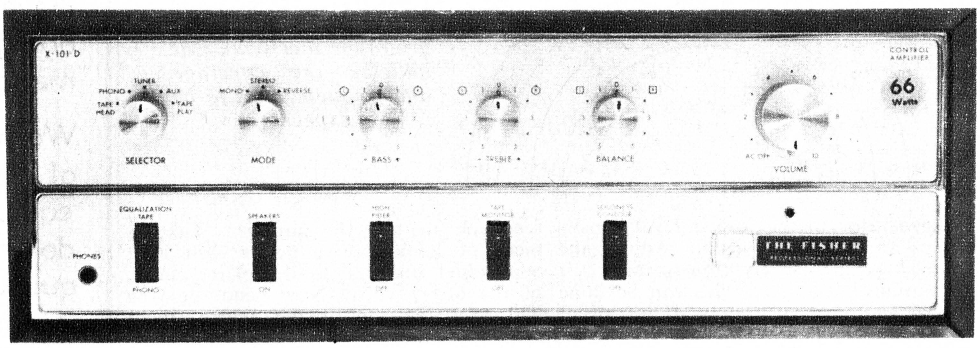

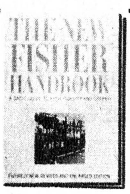

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DESIGN PROCEDURE FOR AEGIS

In addition to providing a range of pre-wound short-wave coils, as featured in our "1967 All-Wave Three" receiver, Aegis Pty. Ltd. have set out simplified design procedures for correlating frequency coverage, tuning capacitance and numbers of turns for typical applications.

By L. R. Mitchell

A problem which is commonly met by those facing the construction of a short-wave receiver is the provision of the necessary tuning coils. In the constructional data, the emphasis is usually on the dimensions, the number of turns and the polarity of connection into circuit. In fact, the most trying problems are often the physical ones of procuring the necessary formers and winding wires, of laying the turns neatly in position, and the provision of means to terminate the windings and to mount the completed component on the chassis.

From time to time, in an effort to facilitate receiver construction, coil manufacturers have released sets of completed coils, intended for use with specific classes of valve (or transistor) and with particular tuning capacitors, to cover particular frequency ranges. While such coils have a place in the scheme of things, however, they cannot hope to meet all demands, because the requirements of individual projects and of individual constructors vary so widely.

As a practical alternative to these familiar problems, the Aegis Company has produced a versatile series of short-wave coils which, with minor adjustments, may be adapted to a wide variety of applications at frequencies ranging from 1.5MHz to 30MHz. Based on a low-loss polystyrene former, these coils exhibit excellent electrical characteristics and are recommended for use in all small-signal applications where stable, high-Q tuned circuits are required.

A ½-inch former has been chosen as representing the best compromise between efficiency and compactness, and three different types of winding configuration have been produced to provide adequate coverage of the range. Each coil is, in effect, a radio frequency transformer complete with tuned and coupling windings. An adjustable screw core allows for easy alignment; convenient single-hole mounting is provided by means of a spring clip.

Figure 1 indicates, in tabulated form, the turns and wire gauge on each of the three basic types of coil. The turns are retained in position by a special coating, which will nevertheless allow unwanted turns to be peeled off as necessary. By carefully noting the number of turns so removed and subtracting this from the figures in the table, the number of turns retained will be immediately apparent.

All wires are coated with an insulation which melts with heat so that tinning of the leads requires only the application of a soldering iron.

Figure 2 shows typical "Q" curves for the three types of coil. It will be apparent that maximum Q and maximum dynamic resistance for the complete tuned circuit, for any given frequency, will be achieved by retaining as nearly as possible the full number of turns provided for the tuned winding. In practice, the need to accommodate definite values of parallel capacitance and to achieve certain figures of frequency coverage, will necessitate some modifications. Primary turns will also have to be adjusted to suit the particular application.

TRANSFORMER TYPE No.	TURNS		SECONDARY WIRE GAUGE
	SECONDARY	PRIMARY	
RFT2	80	40	20/.002
RFT5	24	12	.0201
RFT10	14	7	.029

Figure 1: Set out above are the physical specifications of the double-wound short-wave coils, released by Aegis Pty. Ltd. and referred to quite correctly as "transformers". Unwanted turns can be stripped off easily to secure any desired secondary inductance and primary coupling.

As supplied all coils carry primary and secondary windings with turns somewhat in excess of anticipated requirements, so that modification will normally require turns to be stripped off from both windings.

Tuned circuit calculations can be tedious, especially where it is required to tune a particular range of frequencies with an available variable capacitor. A chart such as in figure 3 can be very useful in all such circumstances, enabling component values to be predicted quickly and accurately with a minimum of calculation. Before proceeding to figure 3, however, it will be helpful to set down some fundamentals of tuned circuit design.

FIXED TUNED CIRCUITS: The basic circuit is given in figure 4a and the standard equation is:

$$f_r = \frac{1}{2\pi\sqrt{LC}} \quad \ldots\ldots \text{(1a)}$$

where: f_r = resonant frequency in Hertz

L = inductance in Henries

C = capacitance in Farads

To obviate calculation this relationship has been plotted in columns 1, 2 and 3 of figure 3 using practical units. In operation it is only necessary to join two known quantities with a ruler when the unknown will appear at the point where the ruler cuts its scale. Practical coil details are indicated directly against the inductance scale and for convenience a wavelength scale has been added.

VARIABLE TUNED CIRCUITS: Variable capacitors used in radio receivers are available in a limited number of sizes only and it is often necessary to modify the law in order to restrict coverage to a particular range. Two methods are commonly used.

The simple shunt method is shown in figure 4b. Given:—

$$\text{alpha} = f2/f1 \quad \ldots (2)$$

where f2 and f1 are the upper and lower frequency limits respectively, and

$$\text{delta Cg} = \text{Cgmax} - \text{Cgmin} \ldots (3)$$

where Cgmin and Cgmax are the tuning capacitor minimum and maximum values respectively. Then:—

$$\text{Cs} = \frac{\text{delta Cg}}{\text{alpha}^2 - 1} - \text{Cgmin} \ldots \text{(1b)}$$

Once again this relationship has been plotted in figure 3 using scales 3, 4 and 5, it being first necessary to calculate values of delta Cg and alpha.

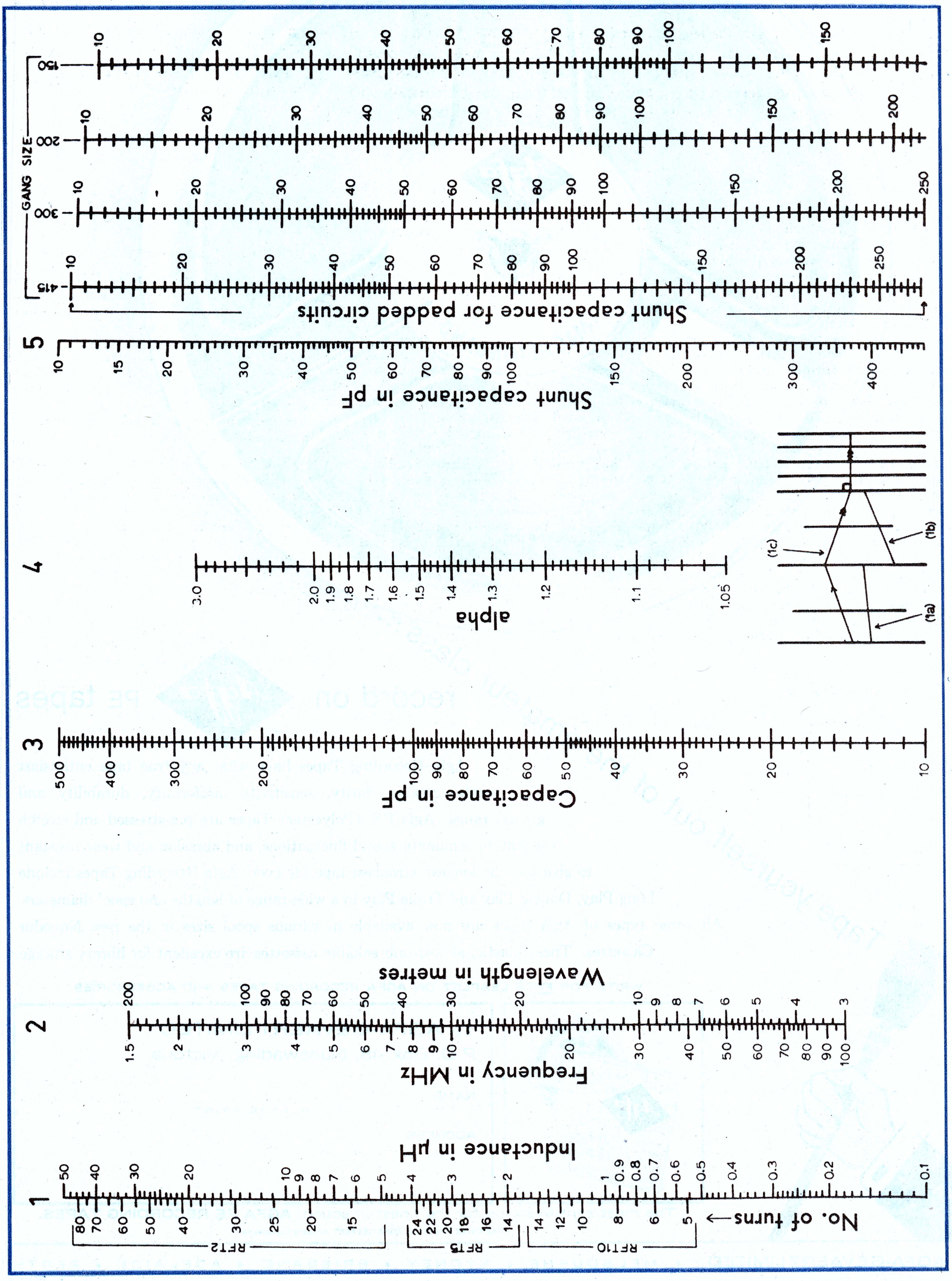
It often occurs that the size of tuning capacitor used is dictated by requirements other than those of the frequency range in question, and the value of Cs may become excessively large. This has the following disadvantages:—

(i) The Q and dynamic resistance of the tuned circuit is considerably reduced.

Figure 3: The nomogram on the facing page allows capacitance, frequency, inductance and turns on a given coil to be read off directly from scales 1, 2 and 3. Scales 4 and 5 extend the possible use of the nomogram to take in problems involving frequency coverage for different values of tuning capacitor and the use of shunt and "padder" capacitors to hold the coverage to desired frequency limits.

PRE-WOUND SHORT-WAVE COILS

At first glance, this nomogram may appear to be upside down. However, it has been printed that way to simplify its use with the magazine turned on its side.



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S300B

(ii) Dial calibration tends to become exceedingly non-linear with frequency.

These disadvantages may be overcome by incorporating a series capacitor (usually termed the padder capacitor) indicated as Cp in figure 4c. The value of Cs for this circuit will be modified by the addition of Cp. It can be shown that, for a particular size of tuning capacitor:—

$$Cs = \text{function}\left(\frac{C1}{\text{alpha}}\right) \quad \ldots (1c)$$

where C1 = capacitance required to resonate with L at f1.

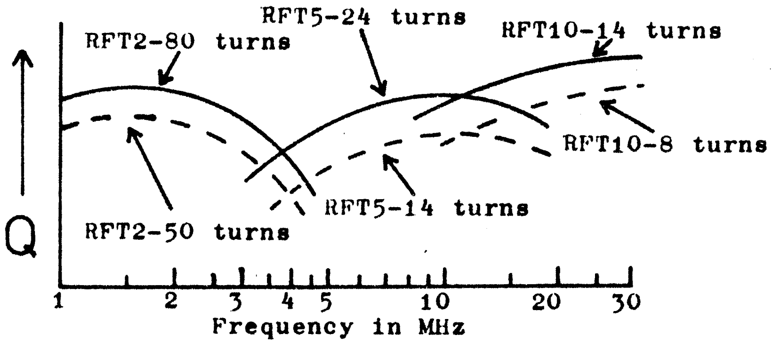

Figure 2: The three pre-wound coils provide potential coverage of the range from 1 to 30MHz considerable overlap. While the various factors are likely to affect the final L/C ratio, efforts should be directed to retaining as much "L" as practicable in the interest of high "Q" and dynamic resistance.

Values of Cs for four different sizes of tuning gang are given in the extreme right hand columns of figure 3 and the appropriate value may be selected simply by following the key.

The value of Cp may now be ascertained by calculation.

$$\text{given } Cc = Cs + Cgmax \quad \ldots (4)$$

$$\text{then } Cp = \frac{Cc \,.\, C1}{Cc - C1} \quad \ldots (5)$$

In the following examples a complete design procedure is given for each of the circuits described above.

EXAMPLE 1: Assume that it is required to design a fixed tuned circuit to exhibit maximum available Q at a frequency of 15MHz. Determine values for L and C.

(a) From figure 2 select a suitable inductor. In this case obviously RFT10-14 turns.

(b) From figure 3(1a) we find that this corresponds to an inductance of 1.61uH and by aligning this value with 15 on the frequency scale, the required tuning capacity is found to be 70pF.

EXAMPLE 2: It is required to tune the range 1.5-4.5MHz. Determine values for L, Cg and Cs.

(a) From figure 2 select a suitable inductor and preliminary value of L which may need to be modified. In this case RFT2-80 turns.

(b) From figure 3(1a) the required resonating capacitance at f1 is found to be 250pF.

(c) Select the nearest standard value of ganged capacitor Cg, say 10-300pF. (10-200pF would not provide sufficient capacitance. This may be verified by substituting that value in what follows.)

(d) From (3) delta Cg = 300 — 10 = 290pF.

(e) From (2) alpha = 4.5/1.5 = 3.

(f) From figure 3(1b) Cs = 26pF.

(g) C1 = Cs + Cgmax = 326pF.

(h) From figure 3(1a) L = 34.5uH (RFT2-62 turns, so that 18 must be stripped from the RFT2-80 inductor, as supplied).

EXAMPLE 3: It is required to tune the range 6-10MHz. Tuning capacitor, 10-415pF.

(a) From figure 2 select a suitable inductor, RFT5-24 turns.

(b) From (2) alpha = 10/6 = 1.67.

(c) From figure 3(1c) C1 = 180pF, Cs = 73pF.

(d) From (4) Cc = 73 + 415 = 488.

(e) From (5) $Cp = \frac{488.180}{488\text{-}180} = 285\text{pF}$.

SUPERHETERODYNE OSCILLATOR CIRCUITS: A basic problem in superheterodyne receivers is that of maintaining a constant frequency difference (equal to the intermediate frequency) between signal and oscillator circuits. This is not practicable using standard tuning capacitors having identical gang sections, but it is generally agreed that the error will be reduced to negligible proportions if precise tracking can be established at three points within the tuning range. Design equations are not simple and many experimenters prefer to select component values on a purely empirical basis.

It is comparatively simple, however, to establish tracking points at each end of the tuning range using the same

method as described in example 3. The third tracking point may then be adjusted during alignment. The following procedure may be applied equally to oscillator circuits operating below the signal frequency, but it should be observed that the signal circuit must be padded and that the roles of signal and oscillator circuits are reversed from the point of view of ascertaining component values.

EXAMPLE 4: Determine oscillator component values for the signal circuit described in example 3. The oscillator frequency is to be higher than the signal frequency and the selected intermediate frequency is 455KHz. For the notation oscillator components will be dashed.

(a) $f1' = f1 + IF = 6 + .455 = 6.455$MHz.

(b) $f2' = f2 + IF = 10 + .455 = 10.455$MHz.

(c) $alpha' = 10.455/6.455 = 1.62$.

(d) From figure 2 select a suitable inductor, RFT5-24 turns.

(e) From figure 3(1c) $C1' = 156$pF, $Cs' = 69$pF.

(f) From (4) $Cc' = 69 + 415 = 484$.

(g) From (5) $Cp' = \dfrac{484.156}{484\text{-}156} = 230$pF.

If the trimmer has to be DECREASED then the oscillator padder must be DECREASED.

(f) Make a small adjustment to the padder as described.

(g) Repeat this procedure starting again at (a) until no further adjustment is required.

Note that as these adjustments proceed it will usually be necessary to remove a few turns from the oscillator coil.

ADDITIONAL NOTES

(1) The practical coil details in figure 3 are plotted for the core in an approximate intermediate position.

(2) In practice, at least portion of C_S is made variable by means of a preset trimmer.

(3) Cp should be a fixed capacitor preferably within 2½ per cent of the calculated value.

(4) It is advisable to make preliminary adjustments to coupling windings before carrying out alignment. This applies particularly to the oscillator coil which should be adjusted for minimum excitation consistent with reliable operation. For valves check the manufacturer's data. Aerial primaries are usually about one quarter of the secondary turns while RF coil requirements may be one third to one half, the primaries normally being interwound with, or adjacent to, the "earthy" end of the tuned winding.

(5) The basic principles outlined above apply equally to valve or transistor circuitry provided suitable matching arrangements are made where required.

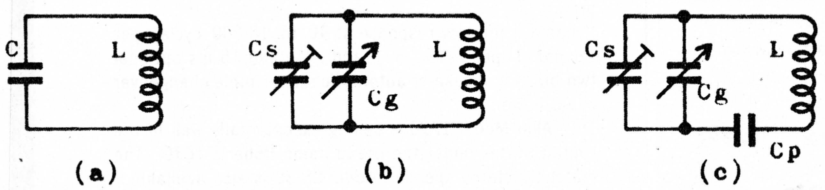

Figure 4: The basis of discussion in the text—(a) is a simple tuned circuit, (b) a tuned circuit with shunt capacitance and (c) a tuned circuit with both shunt and series capacitance.

NOMENCLATURE

fl	lowest frequency required to be tuned.
f2	highest frequency required to be tuned.
alpha	tuning ratio=f2/f1.
Cgmin	tuning gang minimum capacitance.
Cgmax	tuning gang maximum capacitance.
L	tuned circuit inductance.
Cl	Capacitance required to resonate with L at fl.
Cs	shunt capacitance introduced across the tuned circuit.
Cp	capacitance introduced in series with the tuned circuit.

ALIGNMENT PROCEDURE:

(a) With the tuning capacitor fully closed, adjust all cores for maximum signal at f1 e.g. 6MHz.

(b) With the tuning capacitor fully open adjust all trimmers for maximum signal at f2 e.g. 10MHz.

(c) Repeat (a) and (b) until no further adjustment is required.

(d) Set signal source to centre frequency e.g. 8MHz, and tune the receiver to this frequency.

(e) Adjust aerial and/or RF trimmer for maximum output noting whether the capacitance must be increased or decreased.

If the trimmer has to be INCREASED then the oscillator padder must be INCREASED.

TUNING LAW: In the case of padded signal circuits where a wide range tuning capacitor is used it is often practicable and indeed desirable to exercise some control over the rate with which tuning is accomplished, i.e. to arrange component values so that the dial calibration corresponds to a predetermined law, usually with the object of obtaining

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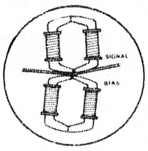

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People throughout the world have come to really enjoy this particular feature, because of the superb results. The Cross-Field System is actually composed of two heads facing one another and so mounted where by their centers are slightly off, as shown in the diagram. This combination of bias and signal heads makes possible clearer responses than the ordinary conventional head, even at slow tape speeds.

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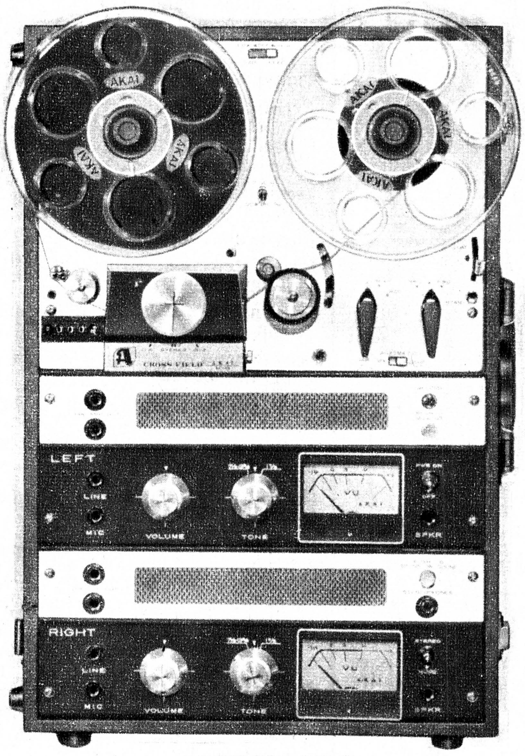

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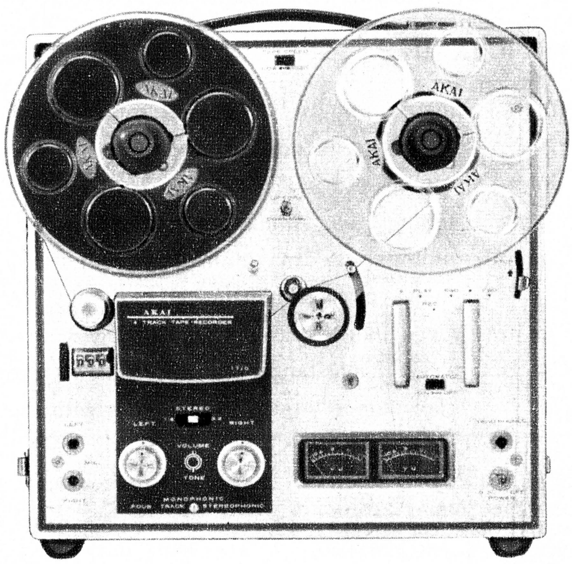
It has a frequency response of 40 to 18,000 cycles per second; 3-speed ($1\frac{7}{8}$, $3\frac{3}{4}$, and $7\frac{1}{2}$) and 15 ips optional two built-in speakers; automatic stop; simple changeover to AC power.

This Akai Model 1710 is selling exceptionally well in the United States under the brand name Roberts 1630. The matching stereo speaker Model SS-30 is also available.



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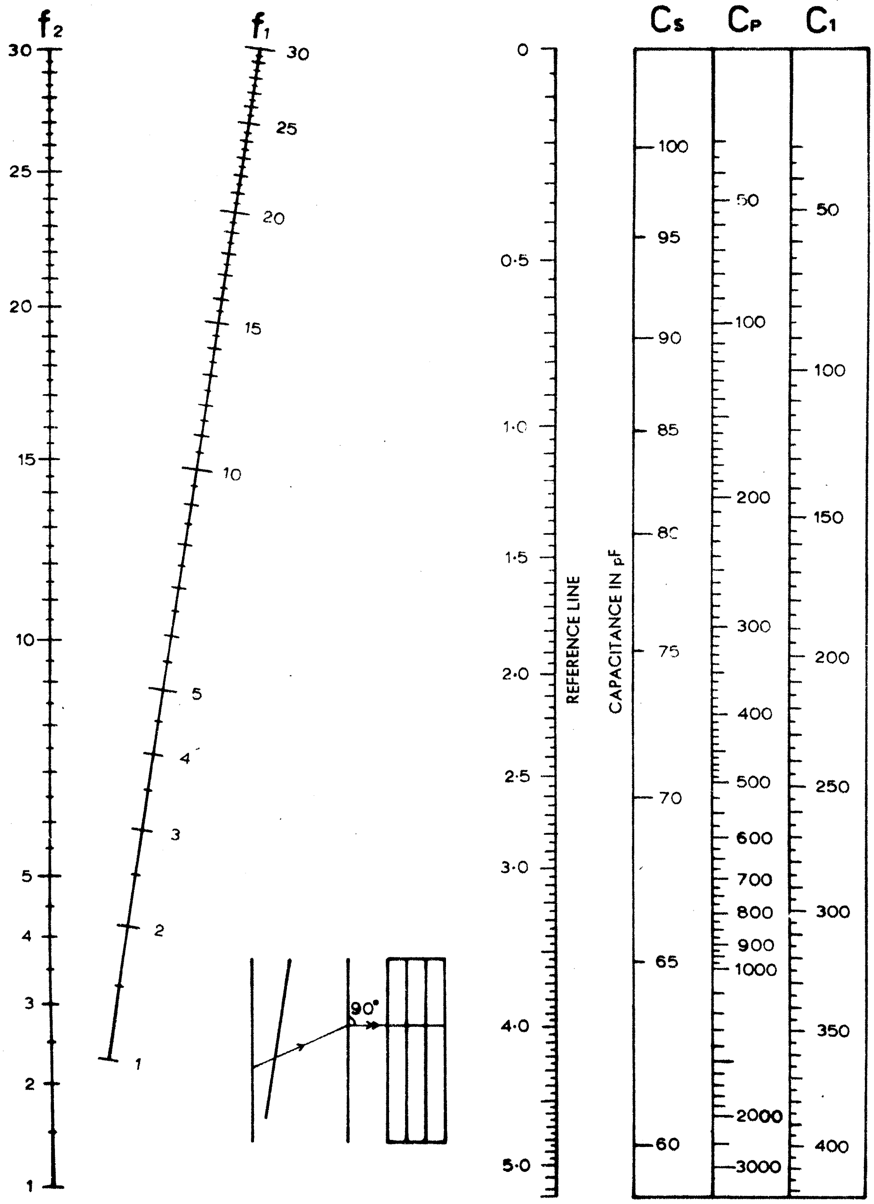


Figure 5: This second nomogram covers a particular case where tuning is to be accomplished by a 415pF ganged capacitor, of a type commonly used in this country for broadcast band receivers. Its use is explained in the text.

a linear or close to linear characteristic. This prevents crowding of frequencies at any particular section of the dial and results in considerably easier tuning over bandspread ranges.

The circuit is the same as that shown in figure 4c and the design problem consists of finding values of Cs, Cp and L so that simultaneously the desired scale calibration and frequency coverage is achieved. Care must also be taken to ensure that alterations to component values do not result in an appreciable reduction of Q.

As previously mentioned, use of a wide range capacitor is indicated and by restricting the application to one particular type of known characteristics it is possible to evolve a practical approach which is very simple to operate indeed. Accordingly the gang selected is of the modern miniature type having a maximum value in the vicinity of 415 pF and being fitted with symmetrically shaped plates. The Roblan RMG 10-415 is typical of this type but other makes having similar characteristics may be substituted.

The design procedure now becomes quite easy and all calculations are eliminated by making use of figure 5. Simply align the two frequencies f1 and f2 with a straight-edge to locate a point on the reference line and by projecting horizontally across from this point the values of Cs, Cp and Cl may be read off directly. The inductance value may then be determined by referring to figure 3(1a) of the previous section. It will be instructive to repeat the earlier example (ex. 3) using this method.

EXAMPLE 5. Required frequency range 6MHz to 10MHz.

Then f1 = 6MHz f2 = 10MHz

From figure 5. Cs = 76 Cp = 298
Cl = 188

From figure 3(1a) L = 3.7uH RFT5—23 turns.

Note that it has been necessary to reduce the inductance value with a consequent loss of Q. This loss is unlikely to be serious, provided the turns on the tuned winding are not reduced by a factor of more than 20 per cent. It will be found that most likely ranges can be accommodated within this limitation.

For superheterodyne oscillator circuits simply add the intermediate frequency to f1 and f2 and substitute these values in the foregoing, viz:

EXAMPLE 6. Assume an I.F. of 455KHz

Then f1' = 6 + .455 = 6.455MHz

f2' = 10 + .455 = 10.455MHz

From figure 5 Cs' = 78 Cp' = 264
Cl' = 175

From figure 3 (1a) L' = 3.4uH RFT5—21 turns

Alignment follows standard procedures and alterations to the padder should not be necessary.

The utility of this system, particularly where a number of ranges are to be covered using a single tuning gang. will be immediately obvious. Close to optimum Q is achieved together with the advantage of a linear bandspread characteristic, while component values may be quickly and accurately evaluated without recourse to calculation. The only limitation imposed is in the choice of tuning capacitor and, where this conflicts with requirements, the general procedure in the first part of the article will provide the necessary solution.

In these discussions the aim has been to avoid complex mathematical analysis and to present the non-professional reader with a practical solution to a constantly recurring problem. No mention has been made of the effects of stray capacitance but some knowledge of practical layout on the part of the experimenter is assumed and these will be taken up during alignment. Nor has any attempt been made to define optimum tracking frequencies as, in most cases, only fairly narrow bands have been considered and the error is unlikely to be appreciable. Where wide coverages are required this should be checked during alignment and, if necessary, the error may be reduced by shifting either or both of the two extreme tracking points to a position slightly within the band limits.

All of the examples along with numerous others have been checked both by calculation and in a practical receiver situation. The author is indebted to Roger Harrison VK3ZRY for assistance in this regard.

Forum

Cold-cathode tubes — mostly harmless!

The letter in the June issue about radioactivity in cold cathode tubes seemed to take most readers by surprise, confirming our original impression that it was a subject to which few had given any thought. A couple of letters now to hand express quite different points of view.

Conducted by the Editor

Before quoting them, however, one correspondent takes us somewhat to task for our handling of the subject. He says:

"As a reader of your periodical for almost a decade, I believe other readers would agree that a topic for these columns, selected upon a statement unsupported by any acclaimed authoritative source, demands a more sophisticated editorial accompaniment than is implied by such references as 'a whip around our staff' and 'answers given off the cuff'."

This raises two points in relation to the conduct of a feature such as "Forum" which, in its present form, is an adaptation of the more usual "Letters to the Editor."

But, whether "Forum" or "Letters To The Editor," a certain amount of selection and editing is necessary, as anyone will know who has sat in any kind of an editorial chair. Some letters merely duplicate the sentiments expressed in others, which have already been selected on the basis of prior receipt or better composition. Other letters are rambling or deal with subjects which are not appropriate to the magazine; a pathetic few would appear to be the product of mental illness.

In selecting letters for publication and possible comment, an editor has to steer a course between freedom of expression and unduly narrow limits based on his own or "accepted" concepts. The letter in the June issue raised what appeared to be a major discrepancy between what is apparently being taught in our Armed Services and concepts in the amateur and commercial world outside those Forces.

Our purpose in seeking unrehearsed reactions to the content of the letter was primarily to emphasise this point: The average commercial engineer, technician, hobbyist and textbook has not given the matter any attention. Further, let's highlight the discrepancy and see what comes out of it!

Something is coming out of it and this kind of "Forum" debate will probably focus more attention on the subject and de-fog more ideas in either direction than any single pronouncement, which many would miss, and with which others would politely disagree.

Be that as it may, we're not unhappy about the way we handled this particular letter, even though we quite appreciate our correspondent's point of view.

Well then, the first letter, which we quote below, is from a member of the Armed Forces who identifies himself but who requests complete anonymity:

Dear Sir,

"I am in a position to throw some light on the subject of radioactivity ('Forum,' June, 1967) since I was involved, to some extent, in propagating the precautions in my branch of the Services, in relation to this hazard.

"It is indeed a fact that many, if not all, cold-cathode tubes used in Service equipment contain radioactive materials and some of them have civilian equivalents. Even those that have no immediate civilian application may find their way into the hands of amateurs and others as a result of equipment disposal, though it is unlikely that bulk stocks of surplus radioactive tubes will ever reach the disposals market.

"The nature and quantity of radioactive material in cold-cathode tubes varies widely. The types most likely to be found in civilian use (e.g. OA2, OB2) contain 0.0067 microcuries of Cobalt 60, considerably less than the activity of a luminous wristwatch. On the other hand, some more specialised types contain as much as 4 microcuries of Radium and some contain gaseous isotopes which become an inhalation hazard if the envelope is broken. One type (no known civilian equivalent) contains 60uC of Tritium gas, H3. Several types contain enough Uranium to be dangerous as a chemical poison, irrespective of associated radioactivity.

"The Service regulations I refer to cover such requirements as standards for packaging (usually in a lead foil box with a radioactivity warning symbol); for storage (limited quantities to be kept in any one box or store, according to the radioactivity content of each type); precautions for the disposal of broken valves; first-aid for cuts by broken glass from radioactive tubes.

"All this many seem pettifogging in relation to the degree of potential hazard for, after all, it is unlikely that any one individual would break more than one or two voltage regulator tubes in a lifetime. Nevertheless, the Forces, in common with other employers, have a responsibility to minimise any danger to which their members may find themselves exposed in the course of their duties.

"Other hazards which are covered by Service regulations include: X-ray emission from valves with high plate voltage; dangerously high RF energy fields; chemical poisoning from burnt out selenium rectifiers . . .etc.

"May I suggest, in conclusion, that there are enough health hazards in radio and electronics to justify a magazine article on the subject, if only to draw attention to the less obvious ones."

Before quoting the second major letter, I would acknowledge a brief note from R. H. of Alphinton, Victoria, who draws my attention to an item in "Radio Electronics" for October 1959, page 99. The wording of this item by E. H. Marriner is such that, on reading it, I couldn't escape the feeling that he was reacting in the same way and to the same kind of tuitional material as quoted by our original correspondent in the June issue.

The item is headed: "DANGER! Some electron tubes are radioactive." It goes on:

"Some of the everyday tubes used in receivers and transmitters contain radioactive materials. The more common of these are regulator tubes—

the OA2 and OB2. Caution in handling cannot be overemphasised.

"The danger is similar to that experienced with early fluorescent lamps. When intact, bulb unbroken, there is no real hazard. The amount of radioactivity is below the level that is considered dangerous. But should the bulb be broken, the radioactive material (cobalt 60 and nickel 63) may be picked up and get into your body—through breathing, eating, drinking or wounds in the skin. These radioactive isotopes—they emit alpha, beta or gamma particles—can injure or destroy blood-forming organs and other tissue. Internal radiation of this type may show up in a few weeks or it may take a few years, because the material fixes itself in the tissue, and its removal from the body is very slow.

"If you should break one of these tubes, remember:

- Don't let any part of the broken tube touch the body. Use rubber gloves.
- Don't bring any food or drink into the contaminated area.
- Wash thoroughly.

"Also, since these tubes can be dangerous, don't let children play with old ones, or break them open to see what's inside.

"A detailed listing of all tubes that contain radioactive substances can be found in the 'Bureau of Ships' journal for December, 1957, published by the Department of the Navy. Aside from the regulator tubes — that section of the listing is presented here—only uncommon types are found (microwave, radar, special-purpose). However, some of these are extremely dangerous, containing much larger amounts of radioactive isotopes. Some have to be marked with a seal showing that they are radioactive, and special disposal precautions must be taken. But the only types you are likely to encounter are regulator tubes. The table shows a listing of these units as shown in the journal."

Type	Isotope	Amount (microcuries)
OA2	Cobalt 60	.0067
OA2-WA	Nickel 63	.01-.05
OA2-WA	Cobalt 60	.0067
OB2	Cobalt 60	.0067
OB2-WA	Nickel 63	.01-.05
OB2-WA	Cobalt 60	.0067

So much for Mr Marriner's item which, as I said, closely parallels the statement in our June issue. Much more positive is the thinking in the second major letter, referred to earlier. The letter is signed but, in deference to medical ethics, we again omit name or initials:

From a specialist:

Dear Sir,—

"If I may presume to comment upon the subject matter of the 'Forum' columns in your June issue, i.e. 'Cold-cathode tubes — radioactivity hazard,' I think that your correspondent, who has led you to introduce this subject, has either misinterpreted the information presented in his course of instruction or has received rather over-enthusiastic if well intentioned tuition concerning the hazards of ionizing radiation.

"As a medical specialist in diagnostic X-ray work, my partnership owns and operates several types of 'Irradiating apparatus' — as legislative authority prefers to term X-ray equipment.

"I can assure you that the Public Health authorities are very conscious of the matter of so-called 'radiation hazards' and each state of the Commonwealth has stringent and extensive regulations not only applying to 'irradiating apparatus' which must be registered and operated by licensed persons and is periodically inspected and monitored, but equally to all radioactive materials which are the source of ionizing radiation.

"To quote from the South Australian Health Act relating to Radioactive Substances and Irradiating Apparatus, the current regulations state in paragraph 11:

"No person shall import, manufacture, possess, store, use, handle, transport or dispose of any radioactive substance or irradiating apparatus except in accordance with the provisions of these regulations. The Act defines 'Radioactive Substance' as a substance which consists of or contains any radioactive element whether natural or artificial.

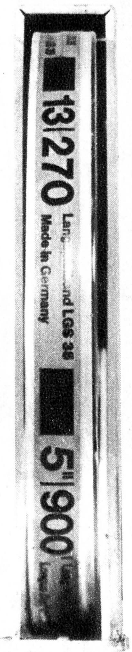
"Radioactive" is defined as 'undergoing spontaneous disintegration of an unstable nuclide with emission of particles or photons, to form a different nuclide." You do not publish the source — other than your anonymous correspondent — of the figures which you quote as the 'Intensity' (the usual technical term is 'actively') in microcuries of the five elements which you list but, according to official publications, the data given is as set out in the accompanying table.

"The deliberate introduction of radioactive 'tracer' isotopes into the human body for medical diagnostic purposes by electronic scanning techniques is now established on such a scale that special departments are be-

ACTIVITY EXPRESSED IN MICROCURIES

Substance	Max. quan. exempt from licensing and monitoring under S.A. Regulations.	Max. permissible burden in a body organ (International Commission of Radiological Protection-Publication 11 and Table 1).	Figures published in June edition of E.A. as "danger levels."
C14	1000	300	5
Cs137	10	30	1
Co60	10	10	1
Ni63	not included	200	1
Ra226	1.0	0.1	0.1

ANNOUNCING . . .



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ing established in the major hospitals to conduct these investigations.

"As radioactive materials utilised for medical and industrial purposes are nowadays almost invariably synthesises, their precise atomic structure is known, their 'half-life' and decay rate are accurately calculated and range from 1622 years in the case of the element radium to 0.3 x 10^{-6} seconds for one of the polonium isotopes.

"The precise proportions of alpha particles (two protons and two neutrons bound together) ejected at 10 cM/sec, beta particles (positrons) travelling at a rate from zero to that of electromagnetic radiation and of gamma radiation emitted is known and able to be calculated and monitored in its effects by scientists working in this field.

"Physicists, expert in monitoring radiation, operate in departments lavishly equipped with an extensive array of electronic test gear, as part of the Radiotherapy Division of practically every major metropolitan hospital.

"The Commonwealth X-Ray and Radium Laboratory in Melbourne conducts a monitoring service for recording the radiation received by personnel associated with radioactive substances or irradiating apparatus in all states and your readers may rest assured that the Public Health authorities supported with the scientific skill of nuclear physicists in the Universities and Technical Colleges are not lacking in expertise or energy in monitoring, inspecting and regulating all possible sources of ionizing radiation which might conceivably be classified as a human hazard"

COMMENT: The first thing that emerges out of the discussion is that, except for Radium 226, there is a wide discrepancy between the "danger level" figures quoted from the Service literature and those from the International Commission of Radiological Protection. The discrepancy is heightened by the fact that the Service literature refers to a quantity of radioactive material present in a radio valve as a mere potential hazard; the other figure refers to the "burden" actually present in an organ of the body. In view of the fact that the latter figures come from an International Commission, concerned among other things with the use of radioactive tracers, it is difficult to regard their figures as other than authoritative.

It would appear that the Australian Service figures are based, at least in part, on British "CV" specifications which are — or have been — "classified" or "restricted" and which are probably of rather venerable age. They would also appear to be conservative in the extreme.

However, even by such conservative standards, few cold-cathode tubes would contain enough radioactivity to cause any apprehension as individual tubes. One list I was able to look at covered about 450 types. Of these about 36, containing mainly Co60 and Ni63, would have been at or above permissible Service limits but well below both the International Commission and South Australian figures listed on the previous page. Another 23 types contained Ra226 at or above the 0.1uC level.

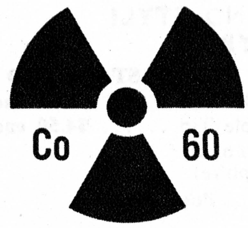
To discover whether or not these figures were typical of other lists from other sources would involve a far greater effort than we can even contemplate at the moment. I imagine, however, that they would be fairly representative.

On this assumption, about 5 p.c. of cold-cathode tube types contain enough radioactivity to pose a theoretical hazard in a "one-off" handling situation. Another 8 per cent would qualify as a hazard on Service figures, but are far below hazard level according to other listed data. The remainder of the tubes are well below even the most conservative danger levels.

Included among the "harmless" types are the popular cold-cathode types mentioned by E. H. Marriner, and one must therefore discount the inference of his item, and perhaps of our June correspondent in these columns, that cold-cathode tubes as a class pose a radioactivity hazard. In fact, the great majority of such tubes, and particularly of those likely to reach commercial and amateur circles, are quite harmless in terms of radioactivity. It is not surprising, therefore, that engineers, technicians and sales representatives in commercial circles seem not to have given the matter a second thought.

Are the "dangerous" tubes marked? The specifications for CV tubes, mentioned earlier, do nominate levels of radioactivity, above which tubes must carry a distinguishing mark, and I imagine that this would be fairly typical practice.

CAUTION



Originally, British-made radioactive tubes carried a warning in the form of an orange band ¼-inch wide. Though this has been superseded, individual, old tubes may be encountered in service situations which still carry the marking.

Later practice is much more positive and I paraphrase from a clipping supplied by a reader, with access to CV specifications:

1. The word "CAUTION" in positive lettering, i.e. printed in the imprinting colour in the ordinary sense. (This is opposite to the American practice where the imprinting colour is used as a large surround and the cautionary word appears by absence of imprinting ink in the background colour).
2. A three-bladed radioactivity symbol, as illustrated.
3. The chemical symbol(s) for the radioactive substance(s) within the valve. As an example, the illustration shows the chemical symbol "Co 60" for Cobalt 60.
4. Imprinting colour—dark violet or magenta.
5. Background colour — not specified for valves but the violet or magenta must be clearly visible against the background.
6. Diameter of symbol must be not less than half the diameter of the bulb or envelope.

So much for the British specification. Other readers who may have access to specifications or details from other countries may be able to add to these remarks. ■

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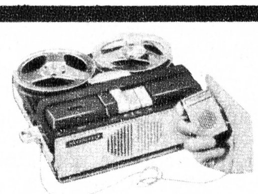

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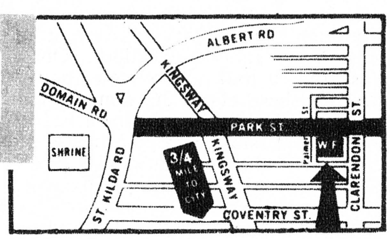

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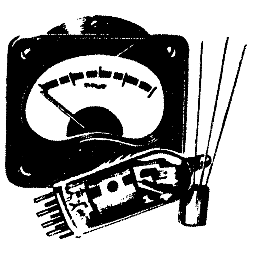


CHAPTER 26: Sound transmission. The TV channel. Receiver functions. The tuner. IF amplifiers. Video detector. Intercarrier sound. Sound IF. Video amplifier. Sync separator. Differentiation and integration. Vertical oscillator. Horizontal oscillator. Flywheel circuits. Vertical output circuit. Horizontal output circuit, EHT, boosted HT, AGC. Power supply.

In the previous chapter we discussed the basic principles of television, the manner in which a television signal is generated, and the final form it takes when ready for transmission. Briefly, this consists of a complex waveform comprising the video information on a line by line basis, interrupted at the end of each line by a line synchronising pulse, and at the end of each field by a block of field synchronising pulses. In this chapter we plan to discuss how the signal is received and processed by the receiver.

First, however, a brief mention of one aspect of the transmission which we had insufficient room to discuss in the previous chapter—the sound (or audio) signal. Because sound transmission is something with which we are relatively familiar, there is a tendency to take it for granted in association with TV. In fact, it must be treated as a part of the overall system if good results are to be obtained.

Early TV systems—including the British 405 line system which is still in operation—used AM sound transmitted on an adjacent frequency. Later systems switched to FM sound, both to take an advantage of the superior noise rejection properties of this system and to simplify some aspects of sound and picture separation in the receiver.

Australian TV uses an FM sound system, with a deviation of plus and minus 50KHz, an audio response to 15KHz, and treble pre-emphasis amounting to approximately 13dB at 15KHz, relative to 1KHz. Treble pre-emphasis is a fairly standard procedure for FM program transmissions to provide as much protection as possible against noise. Complementary de-emphasis is provided in the receiver to produce a level response from the audio system. The sound transmitter is normally located higher in frequency than the picture- or video-transmitter and, in the Australian system, always exactly 5.5MHz away from it. The reason for this precise spacing will be evident later.

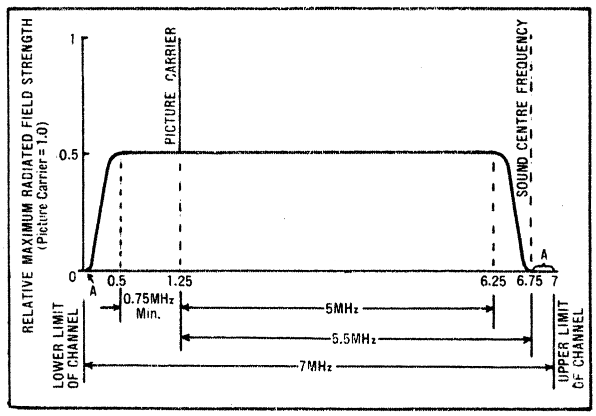
In greater detail, the distribution of signals within an Australian TV channel is as follow: The picture carrier is located at 1.25MHz above the lower limit of the 7MHz channel, the sound carrier is 5.5MHz above this, and the upper limit of the channel is .25MHz above this again. Vestigial sideband transmission is used for the picture carrier, which means that most of one set of sidebands (usually the lower) is suppressed. Australian practice is to suppress all but 1.25MHz of the lower sidebands adjacent to the carrier, and this is the reason for the picture carrier position 1.25MHz above the lower limit. Australian TV channel frequencies range from 45MHz at the lower limit of channel 0 to 222MHz for the upper limit of channel 11.

A brief comparison may be worthwhile here. Whereas one TV channel occupies 7MHz, the entire broadcast band occupies about 1MHz. And into this we can put 100 sound transmissions each nominally 10KHz wide. (In fact, by means of channel sharing, the band is currently accommodating over 180 transmitters.) Thus, on a straight channel for channel basis, the total TV signal occupies 700 times as much spectrum space as a sound transmitter!

From all the foregoing it is quite obvious that the TV receiver has to handle a much more complex signal that a simple sound receiver. For one thing, it has to handle the 7MHz bandwidth of the transmitted signals, at the same time providing compensation for the vestigial sideband transmission and correct levels for sound and video signals to ensure minimum interference between them. And, having done that, it has to sort out the complex of signals which constitute the complete TV transmission. It has to separate the sound from the video, the video from the sync pulses, the horizontal pulses from the vertical pulses, and then process each according to its requirements.

A logical place to start is the tuner. Physically, this is a self-contained unit, which may be mounted either directly on the chassis, or separate from it, where the cabinet layout dictates such an arrangement. Heater and HT power are derived from the main chassis, as is AGC (AUTOMATIC GAIN CONTROL) voltage. Signal from the tuner is fed to the chassis via coaxial cable.

Among other things, the tuner has to tune over a wide range of frequencies—approximately 50 to 200MHz to cover the 13 channels of the Australian system. Fairly obviously, such a requirement is beyond the scope of a simple variable capacitor tuning system as employed in a broadcast or short-wave receiver. Instead, a system of coil switching is employed with a set of coils being switched into circuit for each channel. A small variable capacitor is provided as a FINE TUNING CONTROL, to compensate for drift due to temperature, valve aging, etc.



How signals are distributed within a TV channel. Note the 5MHz space for picture information and the 5.5MHz spacing between picture and sound carriers.

There are two popular methods of selecting coils: (1) by means of more or less conventional rotary switch wafers, or (2) by means of a turret. In the switching system the switch contacts engage connections which are, in reality, tappings on what amounts to one continuous coil. For the highest frequency channel only a small portion of the coil would be in circuit while, for the lowest frequency channel, the whole coil would be employed. This arrangement is called an INCREMENTAL TUNER.

The alternative arrangement provides a set of completely self-contained coils for each channel. These are mounted on plastic bases equipped with suitable contacts and, by reason of their shape and colour, are popularly referred to as "BISCUITS." They are supported between discs mounted on a central shaft,

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in such a way that the contacts face outwards. As the central shaft is rotated, the coil assemblies rotate with it, each set making contact in turn with a set of fixed, wiping contacts. A mechanical indexing system on the central shaft ensures that each set of coils are moved into exactly the right position to correctly engage the contacts. Such an arrangement is known as a TURRET TUNER.

Electrically, tuners consist normally of two stages, an RF amplifier and local oscillator/mixer. The RF amplifier is usually a twin triode in a CASCODE configuration, a very popular arrangement which provides a useful order of gain with low inherent background noise.

The mixer/oscillator stage usually employs a triode/pentode valve, with the triode in the oscillator circuit and the pentode functioning as the mixer. The tuner is designed to have a bandpass wide enough to encompass the full bandwidth of the TV channel—7MHz—and the "Q" and coupling of the tuned circuits are selected with this in view. As with normal superheterodyne practice, the local oscillator runs at a higher frequency than the incoming signal and this transposes the relative positions of the video and sound carriers. Whereas the sound carrier is transmitted as the higher frequency it appears as the lower intermediate frequency.

The Australian system has used two intermediate frequency standards. The first specified 36MHz as the picture IF and 30.5MHz as the sound IF. More recently, alternative values of 36.75 and 31.25 have been adopted by some manufacturers in an effort to minimise spurious patterns which can occur in some circumstances. Note particularly that, regardless of the IF, the 5.5MHz difference between sound and picture is retained.

From the tuner, the signal goes to the IF channel. As well as amplifying the signal, the IF channel has the job of "shaping" the receiver's response to the various frequencies within the passband, an important function which can have a marked bearing on the quality of the picture and sound.

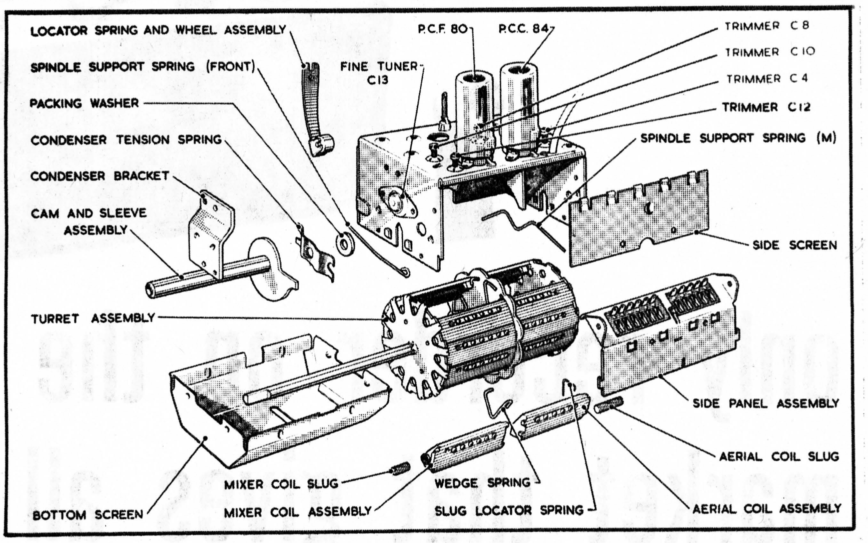
In short, the IF channel, like the tuner, must accommodate the full 7MHz bandwidth of the channel, but with the difference that it is not required to respond to all frequencies equally. To achieve adequate bandwith several stages are employed—from two to four typically—with several tuned circuits. These latter may be loaded wtih resistors to reduce their "Q" and broaden their response, while the coupling between them is arranged also to produce the same effect. In addition, the various circuits are stagger-tuned, that is, tuned to different frequencies within the required passband.

It is usual to refer to the IF channel response characteristic as the SHAPE. This is a convenient concept because the method of adjustment employs a SWEEP GENERATOR and a cathode ray oscilloscope, the latter portraying the response of the channel in graph form. Thus we tend to think of, and discuss, the response in terms of the graph's shape.

One major requirement of the IF channel is to compensate for the vestigial sideband transmission system. As we explained in the previous chapter, all but about 1.25MHz of one picture sideband is suppressed at the transmitter, this being the maximum amount of suppression which is practical at the present state of the art. This means that, for the first 1.25MHz on either side of the picture carrier, the system is essentially a double sideband system, and transmits twice as much sideband power as it does for higher frequencies, where the system is essentially single sideband.

To compensate for this the IF channel must be adiusted so that its response to the 1.25MHz double sideband signals is less than its response to the remaining designed to ensure—for quite complex reasons—that picture signals do not appear at more than minimal strength in the sound system.

From the IF channel the signal goes to the picture—or video-detector. This functions in exactly the same fashion as the detector in a conventional sound receiver and is normally a diode—either valve or solid state. From the detector we get our video signal and, to ensure that the full video bandwidth is obtain-



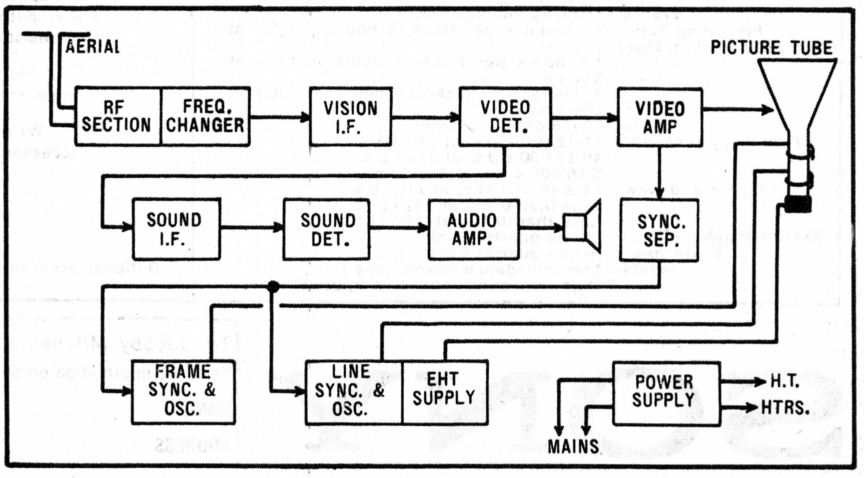
Although a little dated, this exploded drawing of a turret tuner gives an excellent idea of the mechanical principle involved. Ease of coil adjustment or replacement is a major feature of the turret system.

single sideband signal, and by the correct amount at each frequency. Thus the response is "down" at the picture IF (say 36MHz) but increases steadily to 34.75MHz after which it levels off for the remainder of the picture response channel. This extends, in theory, for 5MHz, to 31MHz, although individual IF systems will vary in their ability to reach this value.

Beyond the 31MHz point the response is required to drop sharply before reaching the sound carrier IF at 30.5MHz. Here the response must form a plateau as wide as the deviation of the FM system (100KHz) and approximately 10 p.c. of the height of the maximum picture signal response. The height of the plateau is moderately critical and is ed, extreme care is taken to reduce stray capacitance to a minimum, and to boost the high video frequencies where necessary to offset any losses. The video signals then pass to the video amplifier.

However, another type of signal is present in the detector circuit and the manner in which this is used is one of the cunning tricks employed by TV engineers. The signal is a 5.5MHz beat, caused by the difference between the sound and picture carriers. This beat contains both FM sound modulation and AM picture modulation but, by employing suitable limiting circuits, the AM content can be eliminated, leaving the FM sound signal only.

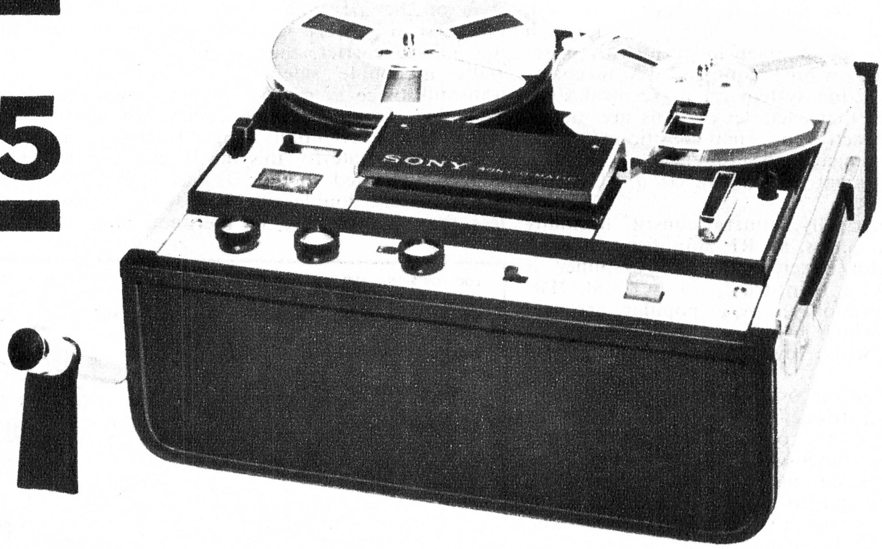
So, connected to the video detector we have an auxiliary IF amplifier, the



A block diagram showing the main sections of a TV receiver. Refer to it as each section of the receiver is discussed.

S26/FP

SONY TC-105



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Recording Time: (With 1800'/550 m. tape)	45 minutes per track, 3 hours in total at 7½ i.p.s. 1.5 hours per track, 6 hours in total at 3¾ i.p.s. 3 hours per track, 12 hours in total at 1⅞ i.p.s.
Reels:	7" (18 cm.) or smaller
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Optional accessories:	Telephone pick-up, TP-4S Microphone mixer, MX-600

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sound IF amplifier, operating at 5.5MHz. It incorporates the necessary limiting stage and is followed by some form of FM detector which extracts the audio component and feeds it to a conventional audio amplifier. De-emphasis of the high audio frequencies normally takes place within this amplifier.

The main advantage of this form of sound system, called the INTERCARRIER system, is that it provides a high order of sound stability. The 5.5-MHz IF is determined by the two transmitter carriers and thus remains absolutely constant, regardless of any drift in the receiver tuner. In older receiver designs (never used in Australia) the sound IF was as delivered by the tuner, and so would vary as the fine tuning control was adjusted. Careful adjustment of the fine tuning control was necessary to produce undistorted sound, while small orders of local oscillator drift in the tuners, having negligible effect on the picture, could seriously distort the sound.

To ensure that the inter-carrier system functions correctly, it is essential that the video carrier never be allowed to drop to zero. Should this happen, there would be no carrier against which the sound carrier could beat to produce a 5.5MHz IF, and there would be a momentary loss of sound. For this reason the transmission standards specify that peak white should never cause the carrier level to fall below a specified value (about 10 p.c.) instead of to near zero, which would be the natural assumption.

The intercarrier system is the reason that the sound channel is so trouble-free in modern TV receivers. No matter how the set is tuned—or mistuned—the sound remains substantially undisturbed. This is a vast improvement on early designs, which were quite critical in this respect.

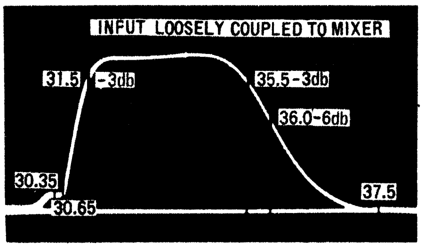
Reverting to the video signal as it comes from the detector, this is then passed to the video amplifier. This is usually a single stage, although some designs may use two stages. The major requirement is a suitable order of amplification together with an adequate bandwidth, the latter requiring, nominally, to cover from below 50Hz to 5MHz. Careful design is required to achieve this, in regard to both the circuit and the physical layout. Stray capacitance must be reduced to a minimum and high frequency compensation used to offset losses which cannot be avoided. In addition, a 5.5MHz trap circuit is employed to reject the intercarrier sound IF signal and preventing it from appearing as an interference pattern in the picture.

Somewhere in the video amplifier there is usually a variable gain control, which becomes the CONTRAST control on the front of the set. This may be regarded as analogous to the volume control on a sound receiver. However, some designers prefer to associate the contrast control with other sections, such as the IF amplifier.

The output of the video amplifier is an amplified version of the composite video signal, i.e., the actual video information plus the vertical and horizontal sync pulses. This signal is fed to the grid/cathode circuit of the picture tube, often via the cathode rather than the grid, for reasons of convenience. The fact that the sync pulses are included is of no consequence, since they are "blacker than black" as already explained.

However, the sync pulses have not yet performed any useful function. Before they can be employed they have to be separted from the video information and the stage which performs this is called a SYNC SEPARATOR. The sync separator is normally fed from the output of the video amplifier, thereby taking advantage of the amplification which this provides.

Separation of the sync pulses from the video information is based on the difference in amplitude between the two.



The "shape" of a TV IF amplifier as displayed on a CRO. It is a practical curve which comes very close to the theoretical ideal. Check the frequencies shown against the text.

The sync separator might best be described as an amplifier stage deliberately biased well beyond cut-off. Imagine a valve operating under conditions of low plate voltage and high negative grid bias. Such a stage would not function at all for signals of only moderate amplitude, but would function during part of the positive cycle if we applied a signal of sufficient amplitude.

In practice, we arrange that the video signal fed to such a stage will have positive going sync pulses. We also arrange the operating conditions of the valve so that the amplitude of the video information is just insufficient to overcome the bias. Only the higher amplitude positive-going sync pulses can do that, and so they appear as amplified pulses, minus the video information, in the plate circuit of the stage.

Since the amplitude of the video signal will vary widely according to the strength of the incoming signal, it is obviously not possible to use a fixed operating condition for the sync separator. Rather must it be able to adjust itself to any likely signal amplitude. This is achieved by using the video signal itself to generate the bias for the stage. Each positive sync pulse drives the grid positive, causes grid current to flow and generates a voltage across a resistor in the grid circuit. This voltage is stored as a charge in a capacitor and is of such polarity and amplitude that it drives the grid beyond cut-off when the sync pulse finishes, and holds it there until the next sync pulse occurs.

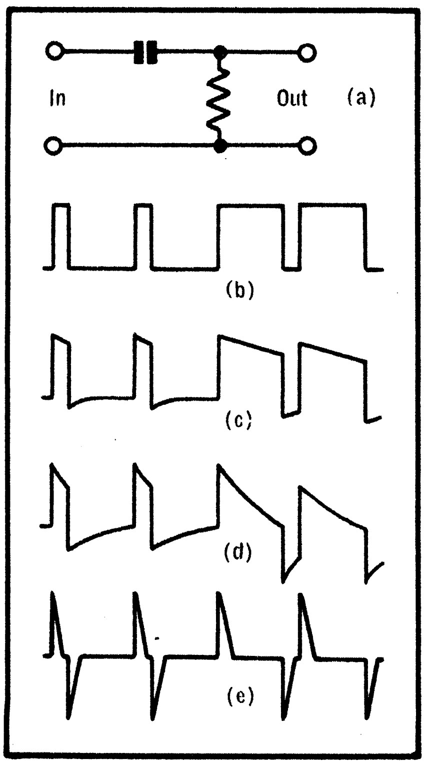
With the sync pulses effectively separated from the video, it is now necessary to separate the vertical and horizontal pulses from each other in order that they may be directed to their respective deflection oscillators. The main difference between these pulses is their duration. The horizontal pulses are relatively short and occur 15,625 times a second. The vertical pulses are, individually, several times longer and, in addition, are presented in a block of five. This block occurs 50 times a second.

The two circuts used to separate these pulses are called the DIFFERENTIATING circuit and the INTEGRATING circuit. The differentiating circuit selects the horizontal pulses and the integrating circuit the vertical pulses. The differentiating circuit may be likened to a high pass filter, or one which does not respond to low frequencies. With associated circuitry it is made to respond to the leading edge only of all the pulses —vertical and horizontal.

The integrating circuit has opposite characteristics, and may be likened to a low pass filter, or one which does not respond to high frequencies. It ignores the horizontal pulses, but responds to the longer, individual, vertical pulses. These it adds together, or integrates, to make one large pulse.

The reason for using five separate pulses, which must be added together to form one large pulse, rather than simply presenting one large pulse, is to enable the horizontal pulses to be retained during this period. It will be remembered that we said that the differentiating circuit responded to the leading edge of all pulses and this fact makes it possible to continue to transmit horizontal pulses, in the form of serrations in the vertical pulse, while the latter is being transmitted. If this were not done, the horizontal oscillator would drift out of sync during each vertical pulse period, and might not be restored in time for the first lines of the new frame.

From the integrating and differentiating circuits the sync pulses are directed to their respective oscillators. The simpler of these two is the vertical oscillator, to which the pulses from the integrating circuit are directed, so we will consider it first.



A differentiating circuit (a) and a normal input waveform (b). At (c), (d), and (e) are the output waveforms as the capacitor is made progressively smaller. The (e) waveform is as required in a TV receiver.

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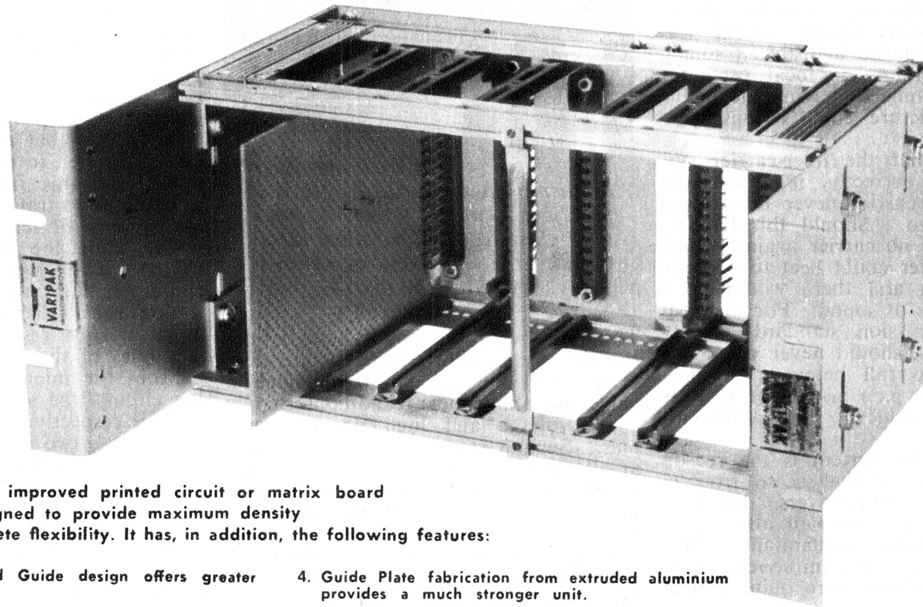

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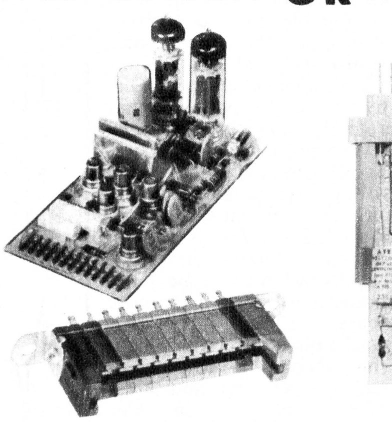

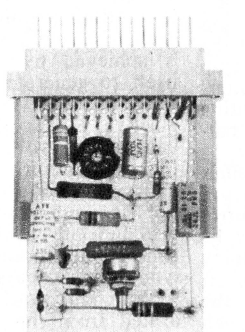

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This oscillator can take a variety of forms, but they all have one requirement in common—ability to be readily triggered by a synchronising pulse. Also, they invariably employ the same basic circuit, a resistor and capacitor in series connected across a supply voltage. Such a circuit will develop a steadily rising voltage across the capacitor, commencing at zero at the instant the supply voltage is applied and rising towards the supply voltage at a finite—and predictable—rate. The actual rate will depend on the values of the capacitor, the resistor, and the supply voltage, all of which may be made substantially constant.

This rising voltage, or a current derived from it, is used to move the scanning beam down the face of the picture tube, thus providing the vertical portion of the scan. When it reaches the bottom of the screen, means must be provided to return it quickly to the top and commence another downwards trace. This is done by rapidly discharging the capacitor, then leaving it to complete another charging cycle, and so on in a regular pattern. This pattern, when portrayed graphically, looks like the teeth of a saw and, in fact, is called a SAWTOOTH waveform.

To discharge the capacitor we might envisage an ordinary mechanical switch which is closed just long enough for this purpose, then opened again to allow the next charging cycle to commence. Fairly obviously, a mechanical switch would be impractical in such a role, but we can use various forms of electronic switch. Typical examples are the thyratron, or gas triode, conventional "hard" valves, or transistors. Only the last two are employed in modern TV sets.

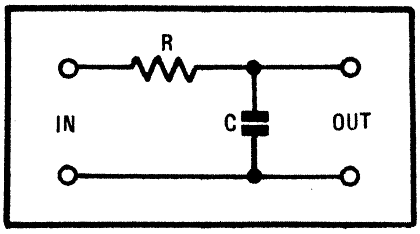
A popular arrangement uses the BLOCKING OSCILLATOR. A blocking oscillator is one which is designed to alternately oscillate and "block" itself off by reason of its own oscillation. As with other types of oscillator, this type generates its own bias by reason of grid current, the voltage being developed across the grid resistor and stored as a charge in the grid capacitor. If these two components are made large enough a burst of oscillation will not only generate enough bias to cut the valve off but this condition will be retained for a relatively long period until the capacitor can discharge through the grid resistor. When it has discharged sufficiently the circuit will again oscillate, and the blocking process will be repeated.

These short bursts of oscillation, separated by relatively long periods of inactivity, can be used to perform the switching function needed to discharge the capacitor in our sawtooth network. The blocking oscillator valve is, in effect, connected in parallel with the sawtooth capacitor, and discharges the latter when it conducts during the brief oscillatory cycle. The time between bursts of oscillation is made approximately equal to the vertical scanning period.

More precisely, it is made slightly longer. Then vertical sync pulses, of positive polarity, are fed to the grid of the valve. These over-ride the negative charge left on the grid, causing the stage to oscillate (and subsequently block) earlier than it otherwise would, and precisely in step with the signals radiated from the transmitter. Thus the vertical deflection circuits are exactly synchronised with the transmitter.

Another popular vertical oscillator circuit is the MULTIVIBRATOR. This requires two amplifying devices and typical circuits usually employ a twin triode valve. Although the oscillator functions in a somewhat different manner, it also depends on the rate of discharge of a capacitor to allow a valve grid to rise sufficiently above cut-off to function, and therefore can be triggered by a positive sync pulse if the natural frequency of oscillation is made slightly slower than is required.

As a matter of interest, the natural rate of these oscillators is normally controlled by the vertical hold control on



An integrating circuit. Compare it with the differentiating circuit on the previous page.

the front panel of the TV set. The user has to set it so that the oscillator stage is running slow and, although he may not appreciate what he is doing, he manages this quite easily by simply adjusting it until the picture locks. The amount by which the stage runs slow is not critical within reasonable limits.

The horizontal oscillator could use similar circuitry to that just described for the vertical stage, assuming that the values of the frequency determining components were changed to suit the line frequency (15,625Hz) rather than the frame frequency. In fact, such arrangements were used in early commercial receivers and may still be used in simple experimental sets. Modern sets use a more refined system which has a number of advantages.

The main disadvantage of the simple system is its tendency to trigger prematurely, due to random noise pulses present with the signal. Unless the signal is very strong, giving a high signal-to-noise ratio, noise pulses can be strong enough to be mistaken for a sync pulse, at the moment the oscillator is primed for triggering by either. The result is a degree of random sideways misplacement by successive lines which, though small, gives the picture a shimmering effect and renders it less acceptable than it should be.

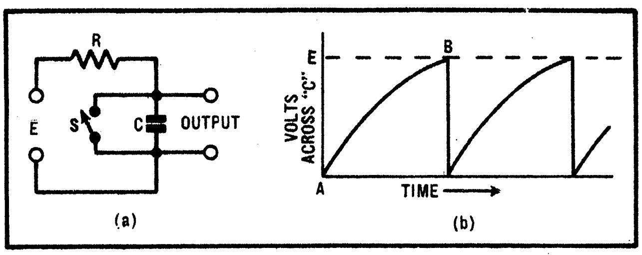
The circuits which have replaced it are generally known under the broad title of FLYWHEEL circuits, though sometimes also referred to as AUTOMATIC FREQUENCY CONTROL (AFC) circuits. (Do not confuse the term "flywheel" used in this context with the same term sometimes used to explain the behaviour of tuned circuits.) The flywheel circuits, as their name implies, behave as if they have considerable inertia. While they are synchronised by the station sync pulses, they will not respond to short-term changes—i.e., from line to line—which may occur, or appear to occur, in the line pulses.

Since, in fact, such changes do not (or should not) occur in properly controlled transmissions, it is quite in order to employ a circuit which is incapable of responding to them. Should they seem to occur they must really be spurious signals and should be ignored.

Such flywheel circuits take a number of forms, but many are based on the use of an oscillator of a type which can be readily controlled by the application of a DC control voltage. This voltage is produced by comparing the phase of a sample pulse taken from the output of the line oscillator, and the sync pulse from the transmitter. While ever these are in agreement, no correction signal is applied to the oscillator but, should an error occur, a correction signal is generated which changes the frequency of the line oscillator by the required amount and direction. However, capacitor networks associated with the control voltage give it a suitably long time constant.

In a discussion of this nature it is impossible to discuss all these circuits in detail. The best we can do is to give a broad outline. One popular arrangement, called the Synchro-Guide, uses a blocking oscillator similar to that already described for vertical oscillators. However, instead of feeding positive sync pulses to the grid of the valve to trigger oscillation at a precise moment, it is fed with the steady positive voltage derived from the phase comparator circuit. This opposes the valve's self-generated negative bias, more or less according to the value of positive voltage, and so varies the time between bursts of oscillation, or the rate at which the oscillator functions.

Basic sawtooth generator circuit, and typical waveform. In practice, "S" is replaced by an electronic switch of some kind.



Another popular system uses a multivibrator oscillator in conjunction with a discriminator circuit. In this arrangement two sets of sync pulses, of equal amplitude and opposite polarity, are applied to a discriminator circuit consisting of a pair of diodes. To this network is also fed a sample pulse from the line oscillator and the comparison of these pulses results in an output which is either positive of negative according to whether the oscillator is running too slow or too fast. Applied to the grid of the multivibrator stage it will either speed up or slow down the repetition rate as required.

As distinct from the circuits just discussed, in which a DC voltage is used to control an oscillator directly, there is also a scheme which employs a more conventional type of Hartley or Colpitts oscillator controlled indirectly by means of a reactance valve. Since oscillators of this type cannot be controlled directly by DC voltages, the DC voltage derived from the phase comparing network is fed to the grid of a reactance

tube. This is made to behave as if it were a capacitor or an inductor and, if connected as part of the frequency determining circuit, will thus vary the frequency in accordance with the DC applied to its grid.

The oscillator itself is not a blocking oscillator, but functions continuously. As such, it is not directly suitable for scanning, but only to control a scanning circuit. This consists of an R/C sawtooth generating network and a discharge valve, the latter being normally held in an overbiased condition. The output from the oscillator is differentiated into a series of sharp spikes, the positive going ones serving to drive the discharge valve into conduction, and allowing it to discharge the sawtooth capacitor.

Neither the horizontal nor the vertical deflection oscillators are capable of generating the amount of power necessary to operate the deflection coils, and each must be followed by an output stage. This is a relatively heavy duty stage, similar in broad concept to the output stage in an audio amplifier. In addition to producing sufficient power, it must also preserve the correct waveform to ensure a linear scan. Magnetic deflection systems require a sawtooth current through the deflection coils, rather than a sawtooth voltage applied to deflection plates. Since the coils are partly resistive and partly inductive the waveforms involved are quite complex.

As nearly as possible, the required waveform is generated in the oscillator stage, leaving the output stage to function more or less as a linear amplifier. However, some compensation can be provided in the output stage and this stage may also carry the so-called LINEARITY control. The vertical output stage is relatively straightforward, the power amplifier terminating in a transformer which couples the stage to the deflection coils and provides the necessary matching and DC isolation.

The horizontal output stage is a rather different proposition, and is another part of the TV receiver where engineers have resorted to a number of cunning tricks to either improve performance or reduce the number or size of the components required. The result of this "simplification" is, rather paradoxically, to make this part of the circuit one of the most difficult for the beginner to follow. Nevertheless, the logic of the circuitry becomes apparent when it is studied in detail and its performance understood.

Apart from its basic job of providing horizontal drive, this stage can be required to perform most of the following functions: Generation of the EHT (Extra High Tension) for the picture tube final anode, generation of an auxiliary HT supply called BOOSTED HT, provision of gating pulses for GATED AGC, and reference pulses for the horizontal oscillator flywheel circuit.

The final anode of a TV picture tube requires a voltage of around 15,000, more or less according to the size and type of tube. Generating voltages of this order presented a problem in early designs, since it meant large and expensive power transformers and associated filter components. Later it was realised that, by using frequencies substantially higher than the mains, much simpler equipment could be used. Not only could the transformer be reduced to a fraction of its original size, but the higher frequency greatly simplified the filter circuits and reduced the capacitance required to a few hunded pF.

And, since there was a high frequency generator already in the set, in the form of the line output stage, it was a natural development to add an extra winding to this transformer, large enough to produce the required EHT. In modern sets the filtering often consists of no more than a small resistor and the capacitance between coatings on the inside and outside of the glass picture tube envelope.

The boosted HT supply is really a natural by-product of an essential part of the deflection system: the DAMPER DIODE. The damper diode is used to suppress unwanted oscillations in the output circuit, generated by the abrupt nature of the waveforms involved. By the addition of a few extra components it is easy to to add from 150 to 300 volts to the main HT line, providing a boosted HT supply of up to 600V and capable of supplying several milliamps. This is most useful for the deflection oscillator and output circuits, where the higher voltages simplifies the generation of linear deflection currents.

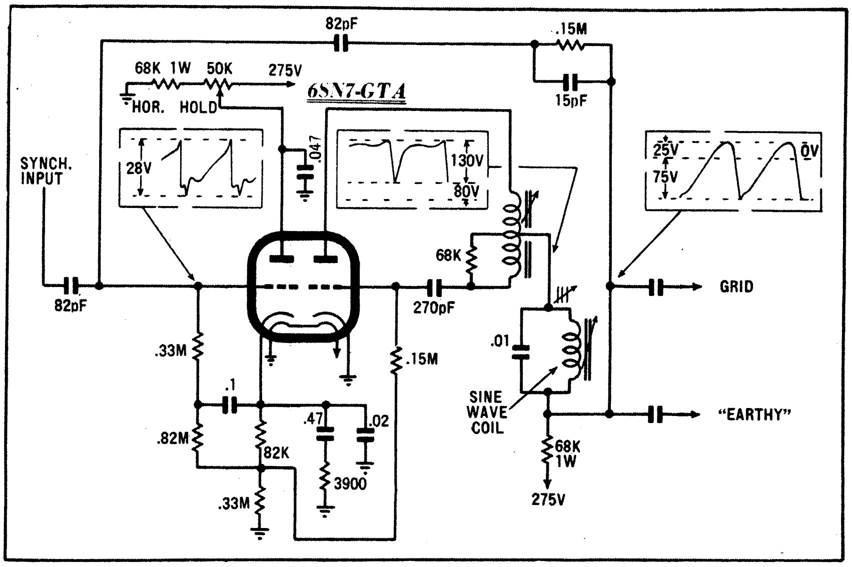
The gated AGC system does for a TV set what a simple AGC (or AVC) does for a sound receiver. It keeps the output very close to constant in spite of large variations in signal strength, particularly between stations. However, the circuitry to perform this function in a TV set is likely to be a good deal more complex than the sound receiver counterpart. One reason for this is simply the nature of the TV signal which, unlike the sound signal, is not a symmetrical one with a constant average output. On the contrary, the output of the transmitter varies continually, according to the light and shade of the picture.

While it is possible to provide a simple AGC system which uses the entire video signal, such an arrangement has limited use in commercial sets. What is needed is a system which will respond to the true signal strength of the transmitter, rather than one which is confused by the varying video content. The only constant level transmitted by a TV station is the sync pulse level, so an AGC system which can be made to "see" only the sync pulses will provide the type of control required. This is the basis of gated AGC.

This system is quite complex in itself and cannot be dealt with in detail here. Sufficient to say that the AGC circuitry is allowed to operate only during the period when sync pulses are being transmitted, from which it develops a steady DC control voltage for application to the tuner and IF stages. The system is made to measure only the sync pulses by "gating" it into operation with a pulse from the horizontal output stage which, naturally, occurs at the same time as the sync pulse.

The need for a pulse to provide a reference for the AFC system has already been discussed. This pulse is often taken from the horizontal output circuit. In other cases it may be taken from the horizontal oscillator.

The amplitude of horizontal signals generated in the output stage is quite high, and can easily cause interference with other parts of the set. For this reason a portion, at least, of the line output stage is built inside a ventilated metal box, called the EHT CAGE.

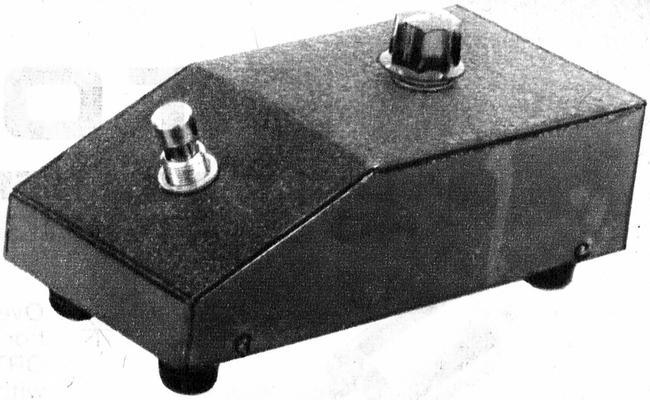


The Synchro-Guide. The right hand triode and associated circuitry is a conventional blocking oscillator. The other triode compares the synchro pulses with the line output pulses, and generates a cathode voltage which is applied to the blocking oscillator grid for frequency correction.

The power supply for a TV receiver is very similar to that used in sound receivers, except that it is a good deal larger. Early designs used valve rectifiers in conventional full-wave circuits, but these have been replaced by voltage doubler circuits using silicon rectifiers, with some saving in space and cost.

Throughout this discussion, explanations have been based on the use of valves for all the functions in a TV receiver. This is logical, since TV sets evolved around these devices, and they are still predominant in locally produced sets. However, all these valves (with the exception of the picture tube) can be replaced by solid state devices (transistors, diodes, etc.) and which will perform as well or, in some respects, better. A number of manufacturers, both locally and overseas, are producing all solid state TV receivers, both portable and full-size. Doubtless it is only a matter of time and economics before they replace valves completely in this role.

A FUZZ-BOX for ELECTRIC GUITARS



The completed fuzz-box, styled to rest on the floor near the guitarist's foot. The fuzz/normal switch is on the sloping panel, while the combined fuzz control pot, and off/on switch is on the horizontal panel.

By Anthony Leo

By popular request we are presenting a small but relatively useful adjunct to our series of guitar amplifiers. This "electronic fuzz-tone generator" may be interposed between guitar and associated amplifier to produce a guitar sound which is known commonly as "fuzz".

From the many requests we have had for such a unit, it is a foregone conclusion that guitar enthusiasts will say: "Thanks; it's just what we've wanted."

It is equally likely that guitar non-enthusiasts will ask: "What the heck is a fuzz-box?" Perhaps we owe such readers an explanation.

Bluntly, a fuzz-box is a piece of circuitry which is introduced into the amplifier chain of an electric guitar, deliberately to distort the waveform. It produces a sound which is "buzzy" by nature, not unlike that from a heavily overloaded amplifier or from a loudspeaker whose voice coil is fouling in the magnet gap. In fact, the similarity of fuzz to overload is no accident, because a fuzz-box deliberately simulates or introduces an overload condition.

By nature, the waveform from an electric guitar ranges from the reasonably sinoidal to one carrying mainly consonant harmonics — depending on playing technique and the position of the pickup coils in use. A fuzz-box squares off, or clips or otherwise distorts the waveform envelope, adding multiple harmonics as it does so, and also adding further dissonant frequencies by intermodulation of those actually being fed in from the pickup coil. The naturally "round" tone of a guitar therefore takes on a strident quality, sometimes considered desirable for its sonic effect.

Just how a fuzz-box treats the wave envelope passing through it depends largely on the circuitry involved. Straight clipping circuits, for example, tend to square off the tops of the waveform, so that predominantly sinoidal waves begin to look quite square on a CRO. As might be expected, the sharper the corners, the wider is the spectrum of the harmonics so generated.

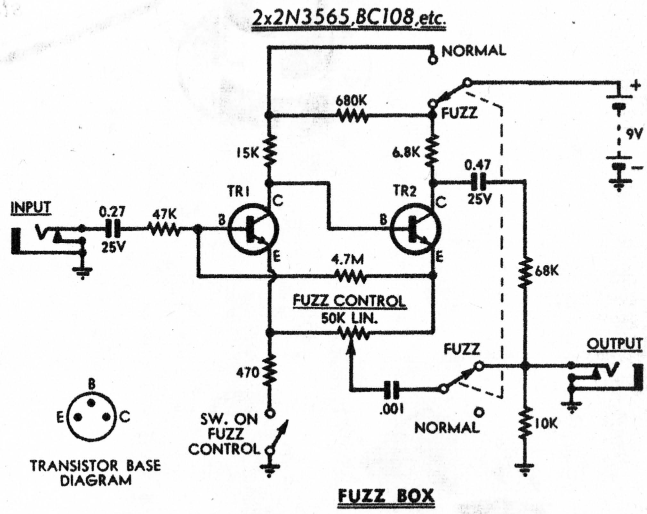
In actual fact, the current generation of guitarists tends to regard squared waves as too conservative in terms of fuzz, particularly when generated from substantially pure waveforms. This arises from the fact that a squared sine wave has a rather pleasant "woodwind" quality and is anything but strident. Again, while a broad spectrum of harmonics may be generated in the first instance by simple clipping, those above about 4KHz don't count for much in the average guitar situation.

The kind of guitar fuzz which is likely to have greater sonic impact is that in which there is a concentration of spurious harmonics within the normal musical range of a guitar system — that is, up to about 3KHz. Aurally, the requirement seems to be met best by circuitry which tends not just to clip waveforms, but to generate waves with generous overshoot at either or both ends of the plateau.

In the face of all this, it is natural to wonder what has happened to all the traditional concepts of minimising distortion in amplifiers. Why has something that has been so wrong for decades suddenly become so right for guitarists?

In part, the answer is that guitarists are creating music, not just reproducing it. If the presentation demands a sound which is strident, the guitarist is at perfect liberty to use an overload condition in the amplifier, if it gives him the effect that he wants.

However, old-fashioned rules still apply. A guitarist may use deliberate distortion to "roughen up" the output from a single string, on the basis that the number of frequencies initially present will not create a higher proportion of intermodulation and other non-musical components than is acceptable for the desired purpose. He may even find it practical to use fuzz for the same purpose with certain simple chords. But, for complex chords or rapid scale progressions, the number of spurious components will usually multiply to such an order that even the most way-out guitarist must stop calling the result "fuzz" and admit it to be old-fashioned and thoroughly unpleasant distortion.



The fuzz-box contains a two-stage direct-coupled transistor amplifier which operates at well under a milliamp of current drain from a small 9-volt battery. If the circuit configuration seems odd, it is basically because the device is designed deliberately to introduce a very large order of distortion.

In short, fuzz is a gimmick intended primarily to add stridency to single tones or, at most, simple chords. It cannot be used with complex chords and must be switched out of circuit before such chords are attempted. For the same reason, it has no place in amplifiers generally, or even in electronic organs, where playing techniques seldom call for single tones.

There are several methods for obtaining "fuzz," probably the simplest being to place two "back-to-back" semiconductor diodes across the speaker connection of the amplifier's output transformer. By connecting the diodes "back-to-back," both positive and negative peaks of the signal excursion are clipped.

Unfortunately there are certain disadvantages with this very simple method:

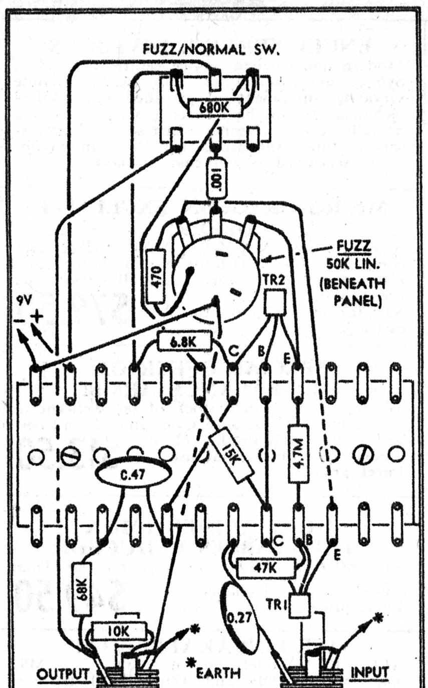
(1) Having the fuzz circuitry applied to the amplifier rather than to the individual guitar means that the amplifier can only be used by one guitarist.

(2) Because the diodes are virtually a short circuit across the output transformer, when conducting at the peaks

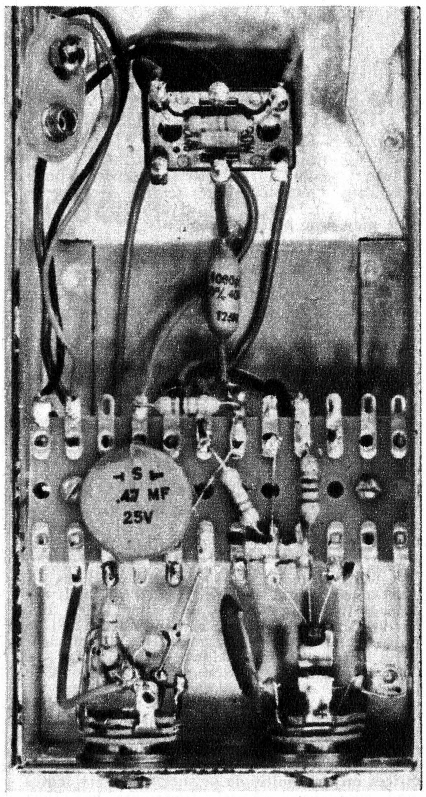
of the signal excursion, severe stress may be imposed on the output stage.

(3) Being a virtual short circuit at signal peaks, the diodes restrict the available output power and so cause an appreciable decrease of volume and power when "fuzz" is applied.

A rather neater method of using diodes is to introduce them across one of the voltage amplifying stages of the amplifier, the point being carefully chosen in relation to signal level and the position of other circuit functions such as volume control, tone control and vibrato. The method avoids waste of power output and stress on the output-stage but it still causes a change in level and still imposes the limitation that the amplifier can serve only one guitar at a time. We had a close look at the idea during the early stages of this present project but rejected it, for the stated reasons. As well, we could foresee difficulties in providing foot-switch control, without becoming involved in a relay or inconveniently long shielded cables.



The diagram above and the photograph at left should make it possible for readers with only very limited experience to construct the fuzz-box for themselves. Some kind of clip or strap will need to be provided to hold the battery in position, while still allowing for replacement at infrequent intervals.



At this point, it is appropriate to mention that there is a fundamental problem in the use of diodes for clipping, intrinsic to the semiconductor diode itself. Basically, such a diode is comprised of a junction of P and N-type semiconductor, the P-type semiconductor having a deficiency of mobile electrons, while the N-type has an excess of mobile electrons. When the two types of semiconductor are brought together to form a junction, there is a migration of the free electrons which tends to form a potential difference across the junction somewhat akin to "contact potential" of a thermionic diode.

This means that, for the diode to conduct in the forward direction, the applied voltage must be larger than the intrinsic "contact potential" of the junction. For this reason the diodes must be placed in the circuit at a position where the peak signal swing greatly exceeds the diode potential, or as it is more commonly stated "the forward biased diode voltage drop." For reasonable clipping, the signal swing should be at least one volt peak.

Since the output signal from an electric guitar is typically less than 30mV peak, it is not practicable to achieve any useful order of clipping by introducing diodes directly across the guitar signal line. Thus, if fuzz circuitry is to operate in the signal line of individual guitars and ahead of the main amplifier, something other than diode clipping is called for.

The method which is preferred, and the one we have used, is to pass the guitar signal through a small transistor amplifier whose operating conditions can be modified to operate in overload mode from direct guitar signals. By building this kind of circuitry into a small box, complete with switch, each player can have his own independent fuzz box and players can share common amplifiers if they so desire.

A further advantage is that, with suitable provision, the relative loudness of the signal, with and without fuzz, can be made much the same, obviating any need to readjust the volume simultaneously with a switch from fuzz to non-fuzz.

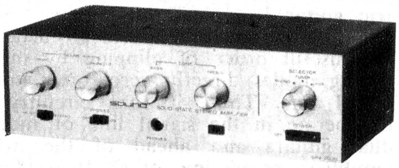
The characteristics of our own unit may be summed up as follow:

(1) Completely self-contained, connecting between an individual guitar and its normal input jack to the main amplifier. While designed primarily to go with our current Playmaster 116 and 117 amplifiers, it will operate equally well with any normal guitar system.

(2) Output on "normal" and "fuzz" is at substantially the same level and, in both modes, the unit contributes a small amount of gain.

(3) In addition to the normal fuzz footswitch, a control allows the degree of fuzz to be varied as required.

As can be seen from the circuit diagram, the device consists of, basically, two DC coupled transistors operating as an amplifier in the guitar line. With the switch in the "fuzz" position, as shown, the load seen by the first transistor is the sum of 15K and 680K ohms and



LOW PRICED SOLID STATE STEREO AMPLIFIER

With 6 watts R.M.S. per channel, the Sound Model SAQ-202B must be regarded as exceptional value at this price. Separate bass and treble controls, input sens. is 100 mV. for pick-up, tuner and auxiliary. In attractive metal case. Frequency response is 20-20,000 Hz. plus or minus 3 dB. 12 transistors **$49**

INTERCOMMUNICATION SYSTEMS

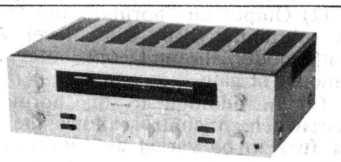
Look at these prices—and the variety! Gem 2 station—**$9.50.** Gem 3 station—**$11.50.** Eden 4 station—**$27.50.** Eden 7 station—**$35.50.** Fountain 2 station—**$14.10.** Fountain 4 station **$27.10.** Fountain 7 station—**$44.** All models are suitable for office, school and home and are fully transistorised.

IMPROVE STANDARDS WHEN RECORDING—DEMAGNETISE!

Two new tape head demagnetisers are now available . . . the single probe is Encel priced at $3.50 and the double probe only $3.00. Recording heads may be demagnetised in a few seconds and quality of recordings improved considerably. Essential for all tape enthusiasts.

SHORT OF SPACE? BUY A WHARFEDALE "LINTON"!

Only 19" x 10" x 10" but a proven performer as a compact speaker system. Ask for an EMQ or a trade-in valuation.



COMPARE THE QUALITY OF THE NEW "SOUND" SAT-200X STEREO TUNER/AMPLIFIER

Here is an effective combination stereo tuner/amplifier with plenty of power for realistic stereophonic listening. Frequency response from 20-20,000 Hz plus or minus 1 dB., output is 12 watts R.M.S. per channel (36 watts total music power). PP 6GW8's are used in both channels. The stereo AM tuner pulls in distant stations . . . and an FM stereo Multiplex tuner may be added. Switches are provided for scratch suppression, loudness control, rumble filter and tape monitor. Stereo 'phones plug into the front panel. All normal mode and tone controls are standard. Beautifully finished, this versatile amplifier has been designed for use with magnetic or ceramic/crystal pick-ups. Ask for detailed specifications **$148**

SEE YOUR NEAREST ENCEL STEREO CENTRE FOR REDUCED PRICES ON THE FAMOUS LEAK SANDWICH SPEAKER SYSTEM!

The new reduced price applies at all Encel Stereo Centres . . . and stocks are also available of the new Leak Mini Sandwich. Both systems provide excellent audio, the smaller unit differing only in the lowest octave. Write for an EMQ or a trade-in valuation.

WHAT IS AN EMQ?

Because of trade agreements many prices cannot be advertised so we advise you to write to us for an EMQ . . . an Encel Mail Quote. Please print your name and address in BLOCK LETTERS . . . and, if you're writing for amplifier or tape recorder information, please be reasonably specific as our stock of these items is extremely wide. Help us to help you! Ask for copies of reviews.

ENCEL SERVICE DIVISIONS

Modern and efficient service centres operate in Sydney and Melbourne. Up to the minute servicing equipment is provided and skilled technicians who have been specially trained actually save you money when service is necessary as time expended is kept to a minimum. Encel service does not **cost—it pays.**

MICRO/ORTOFON EXCLUSIVE OFFER!

A new model MA-77 or MA-77S tone arm complete with an Ortofon S-15 T stereo cartridge (diamond stylus, naturally) will be supplied for .... Ask for an EMQ on the S-15 cartridge only. **$79.50**

SPECIAL OFFER ON ALL-BALANCE ARMS!

We now have limited stock of the well-known and popular All-Balance tone arms—brand new and fully guaranteed. 12 in. model, for professional use. **Encel price** **$13.50**

DUAL MODEL 1010 A TURNTABLES REDUCED!

List price is $69.80 for this popular Dual automatic record changer. **Encel price** is now **$49.50**

ASK FOR AKAI PRICES!

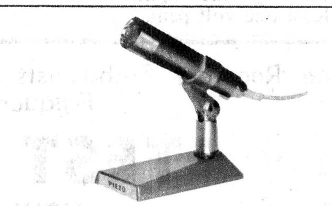
ALL AKAI models are in stock . . . M8, X4, 355, X1000D and 1710. Encel trade-in prices and end-user EMQ's are more than just attractive, too!

LOW PRICED CERAMIC CARTRIDGE FOR BUDGET CONSCIOUS MUSIC LOVERS!

Now the well known Micro Model SC301 Ceramic Stereo Cartridge with diamond stylus is available for only **$6.90.** Frequency response is 20-15,000 Hz. Tracking angle is 15°. This popular stereo cartridge is A1 value at **$6.90**

TANDBERG "SERIES 12" RECORDERS AVAILABLE FOR IMMEDIATE DELIVERY!

This professional stereo recorder has proved to be a best-seller and stocks have been in one door and out the other . . . but now delivery is immediate. Write for trade-in valuations or an EMQ. Your great leap forward to Tandberg could cost less than you imagined at Encel Stereo Centres . . .



NEW UNOBTRUSIVE DYNAMIC MICROPHONE

The robust, pint sized dynamic microphone, the Piezo Model DX75, is supplied with a desk stand. Dual impedance is 50 k ohms and 50 ohms. Ideal for tape recorder applications. Exceptional value at **$6.90**

GET THE ENCEL FACTS

Pamphlets and technical specifications are usually available for most Encel merchandise. Write or call for further information.

THE NEW ORTOFON S-15 STEREO CARTRIDGE AVAILABLE AT ALL ENCEL STEREO CENTRES!

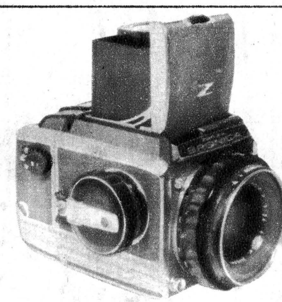
World wide acclaim provides significant testimony to the outstanding performance of the new S-15. Ask for an EMQ or a trade-in valuation.

HIGH FIDELITY STEREO 'PHONES COST LESS AT ENCEL ELECTRONICS!

Several wide range stereo headsets are now available — all are fitted with comfort-plus earpads which also reduce external noise. The Sonics costs only $11.50; the popular Elega is fitted with separate volume controls on each earpiece and is priced at only $13. Connections are made with standard PMG type jacks. If your amplifier is not fitted with a headphone socket, we will supply an easily fitted junction box for only $3. Stereo playback becomes more realistic than ever with hi-fi phones. From **$11.50**

SAVE YOUR RECORDS . . . USE THE UNIVERSAL "LUSTRE" TONE ARM LIFT!

This beautifully finished universal lift will fit all tone arms — the lowering action is hydraulically dampened and extremely smooth. The risk of record damage may now be eliminated **$8.50**



NEW ZENZA BRONICA CAMERAS

The most famous 2¼ squ. reflex cameras in the world would be the Hasselblad and the Zenza Bronica — but only the latter has incomparable Nikkor lens equipment and a focal plane shutter. In consequence supplementary lenses are much lower in price. . . . The new model S2 Bronica has a detachable film back enabling change of film type in a few seconds and is attractively priced at $299 complete with f2.8 75 mm. lens. The model C2 sells at only $245. Both prices include sales tax. Encel Electronics Pty. Ltd. is the Australian Agent for Zenza Bronica. Ask for prices on the multitude of supplementary lenses and accessories. **Encel prices are less than ½ U.K. prices and less than ⅔ U.S. prices for identical cameras.**

Model S2—$299

Model C2—$245

NEW SYDNEY ENCEL STEREO CENTRE A MUSIC LOVER'S MECCA!

Although only just over one year old, the Sydney branch of Encel Electronics is a very healthy infant. Situated on the Ground Floor of the 2SM Building at 257 Clarence Street, the store incorporates a complete Service Centre. Harbor City music lovers are always welcome . . .

Encel ELECTRONICS PTY. LTD.

Head Office: 431 Bridge Rd., Richmond, Vic. Tel. 42 3762

Sydney Store: 257 Clarence St., Sydney. Tel. 29 4563, 29 4564

Australia's Greatest Hi-Fi Centre

* Wholesalers * Trade-Ins Accepted

PARTS LIST

1 small black box (see text).
1 double-pole double-throw switch (see text).
2 shorting type jack sockets.
1 small 9V battery and connector.
1 12-lug length of miniature resistor panel.
1 knob for fuzz control.
1 50K lin. taper potentiometer, with switch.
2 transistors, type 2N3565, BC108 or similar.

RESISTORS
(All ½-watt types)
1 x 4.7M, 1 x 680K, 1 x 68K, 1 x 47K, 1 x 15K, 1 x 10K, 1 x 6.8K, 1 x 470 ohms.

CAPACITORS
1 .047uF 25VW ceramic.
1 .027uF 25VW ceramic.
1 .001uF LV plastic.

this, with the forward bias applied, is sufficient to bring the stage near to current saturation. Because the second transistor base is DC coupled to the first collector, the second transistor will simultaneously be held to near cut-off.

When a sinoidal signal, which has positive and negative peaks, is applied to the first transistor base it will be driven alternately positive and negative. On the positive swing of the input signal the transistor will be driven into complete saturation, so limiting the collector's voltage swing and resulting in a clipped signal peak at the collector.

On the other hand, however, the quiescent voltage across the load is sufficient to allow a full and unclipped collector voltage swing on the other half-cycle of the signal. The resulting waveform at the first collector is therefore a sinusoid with a clipped negative peak.

Now for the other transistor The unaffected signal peak at the first collector will drive the second transistor into complete cut-off, thereby delivering a signal at the output which has both peaks clipped. This statement rests on the assumption that the output from the guitar will be sufficient to overdrive the transistors, but this will normally be the case **provided that the guitar is operated with its own volume control fairly well advanced.**

The actual gain through the fuzz unit is largely a function of the output divider, the 10K and 68K resistors being chosen to give a small amount of gain in both modes, actually about 1.5 times.

However, as we have already pointed out, waves which are merely squared have a rather modest sound, in terms of fuzz, and further elaboration of the distortion circuitry is called for, at least for the more extreme effects.

Looking again at the circuit, a distorted signal appears also at the emitter of the second transistor and, by adding the higher frequency components from this distorted and out-of-phase waveform to the output from the collector circuit, the end result is a large spike above the trailing edge of the initial, squared output waveform.

By using a potentiometer as the emitter load for the second transistor, it is possible to vary the basic fuzz shape to one with the superimposed spike, as already mentioned.

When the "box" is switched to normal operation two things happen. Firstly, the operating condition of the transistors is changed so that they give linear amplification; this is done by switching the collector loads of the transistors. The second step is to disconnect the harmonic adding circuit, involving the .001uF capacitor from the "fuzz control" potentiometer.

Constructionally, the most important aspects of the device are that it should be small and robust. Our own prototype was built into a small steel box which is readily available from R. Moody and Co., of 126 Bombay St, Lidcombe, N.S.W. Similar boxes will doubtless be made available in due course by other suppliers. The main body of the box measures 6⅜ x 3 inches, being 1¾ inches high at one end and ¾in at the other. A bottom plate with turned-up flange, and carrying four rubber feet attaches to the underside by self-tapping screws.

The switch, mounted on the sloping

ERRATA and NOTES

Playmaster 116 Guitar Amplifier, June, 1967. Correction to parts list: Three 1M resistors were omitted.

Playmaster 117 Guitar Amplifier, July, 1967. Correction to parts list: Three 1M and one 68K resistors were omitted.

Playmaster 116, 117 Guitar Amplifiers: A power diode, type 1N3193, should be included in both the 40 and 60 watt guitar amplifier designs. The diode is connected across the 100uF screen supply electro, with its anode earthed, such that it is normally not conducting. It was pointed out and confirmed in our own workshop that, in the original design, a small negative potential would be developed across the abovementioned electro when on standby. In the interests of a completely valid design, the particular diode is considered necessary so as to completely safeguard the electrolytic capacitor.

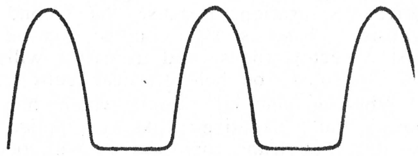
Thyristor Train Controller, March, 1967. The parts list shows three 0.47uF capacitors. This should be two, to agree with the circuit diagram.

DC Supply for Transistors, April, 1966. The 10K wire wound potentiometer shown in the parts list should be 2K as in the circuit diagram.

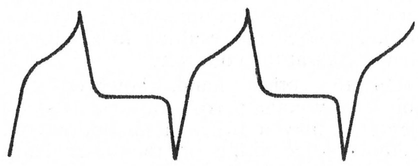
front panel, must be of the double-pole double-throw variety and sufficiently robust to withstand operation by a none-too-gentle foot. Suitable switches may be available from a number of sources but the one on the prototype came from A. E. Ackland of 321 Prince's Highway, St. Peters, N.S.W.

The outside of the box is finished in black-crackle baked enamel with the contrasting chrome finish of the push-on push-off switch. The knob used was one of the black instrument style knobs, featured in our recent guitar amplifiers, with a white-line pointer to indicate the off and on positions.

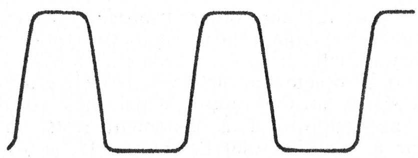
The wiring of the device is quite straight forward and, in our case, was



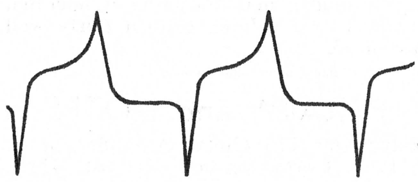
MIN. FUZZ—30mV RMS INPUT—120mV P-P OUTPUT



MAX. FUZZ—30mV RMS INPUT—360mV P-P OUTPUT



MIN. FUZZ—60mV RMS INPUT—120mV P-P OUTPUT

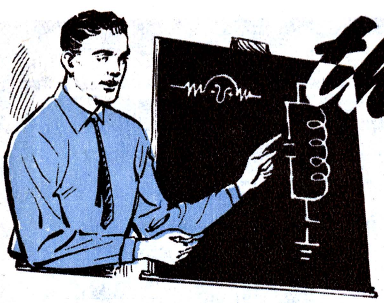


MAX. FUZZ—60mV RMS INPUT—520mV P-P OUTPUT

Shown above are typical waveforms from the unit. As can be seen, the "fuzz" at minimum is amplitude dependent but at higher levels of distortion the waveform is determined mainly by the "fuzz-control" setting

accommodated on a strip of miniature resistor panel. The panel contained 12 solder lugs down each side, and was secured in the box by two $\frac{1}{8}$in Whitworth screws on two $\frac{3}{8}$in spacers. The box which we used was cadmium plated and earth connections could be soldered directly to the inside which had been left unpainted.

Users will need to remember to switch the unit off at the end of each performance, to obviate unnecessary drain from the battery. Fortunately, the penalty for occasionally forgetting to do so is not very great since, as already mentioned, the current drain is less than a milliamp and, overall, the battery should last for about its natural shelf life.



the "Answer Man" Explains

Schematic, Block and Equivalent Circuits

Electronic circuits are common enough things but one of our younger readers has discovered that there are other things called "block schematic circuits" and "equivalent circuits."

What is the difference between a circuit, a block schematic circuit and an equivalent circuit? I have seen all three terms used at various times.

In the ordinary sense of the term, a "circuit" is what we publish each month for projects. It uses a more or less formalised set of symbols to represent resistors, inductors, capacitors, transformers, etc., each marked with the appropriate values and ratings. These are interconnected by lines representing the actual electrical interconnection within the equipment. With such a circuit—often called a "schematic circuit"—it is possible to analyse the operation of a proposed piece of equipment in detail, or build it from the requisite parts, or work out what may have gone wrong when the said equipment fails. We use schematic circuits when working out a design and publish them for the guidance of intending constructors. Similarly, manufacturers make them available for use by people who may have to service their equipment in the field.

In contrast with an ordinary schematic circuit, a "block schematic" circuit, or a "block diagram," contains much less detail. In fact, it may contain virtually no detail of either components or wiring, its normal function being to convey to the reader no more than a broad impression of what a particular piece of equipment does—or how it goes about doing it.

Mostly it uses rectangles, suitably branded to represent whole stages or groups of stages, with interconnecting lines which represent the path followed by the signal being handled plus, in some cases, an indication of power supply or other arrangements.

To take a typical case, the full schematic circuit of a superheterodyne receiver would show all the valves or transistors, all the coils, IF transformers, resistors, capacitors, etc., and the entire interconnection network from aerial input terminal to the loudspeaker voice coil wiring.

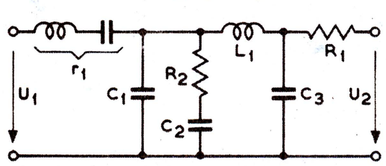
A block schematic, on the other hand, may have a rectangle marked "Frequency Changer," with a single line running to another rectangle marked "IF Amplifier," thence "Detector," "Audio Amplifier" and, at the end, "Loudspeaker." Another rectangle, somewhat separated from the rest, might be marked "Power Supply."

In the context of an elementary textbook, this diagram might serve to illustrate paragraphs reading like this:

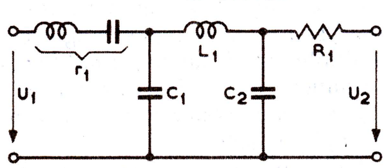
"The incoming signal passes first to a Frequency Changer stage, where it is changed to another, usually lower, frequency called the Intermediate Frequency or just IF. At this new frequency, the signal is amplified in an IF Amplifier stage. Thence it passes to a Detector . . ." and so on.

While block schematic diagrams have their uses in elementary textbooks on radio, they find equal application at a much higher technical level. For example, anyone faced with the full schematic circuit diagram of a computer—if such a thing has ever been drawn—one would find it quite impossible to gain any real value from it; it would be just a huge, bewildering maze of symbols and lines.

EQUIVALENT CIRCUIT OF LF SYSTEM



EQUIVALENT CIRCUIT OF HF SYSTEM



We borrowed these two diagrams from an article in "Hi-Fi News" by B. Weingartner. They are equivalent circuits illustrating the behaviour of acoustic elements in an AKG microphone, relative to low frequency and high frequency sounds. Pressure × area is likened to voltage, velocity to current, friction to resistance, mass to inductance, and spring to capacitance.

In complex equipment like this, it is quite normal to rely heavily on block schematics to convey information as to the general mode of operation. Even the engineers who work on such things are tending more and more to think in terms of "black boxes" designed to perform certain functions, leaving it to others to work out the details of what goes inside the various basic units.

And that's about the only level at which schematic circuits of computers and similar items can exist—in the factories which, perhaps quite independently, produce the basic building blocks from which a complete computer or other system is assembled.

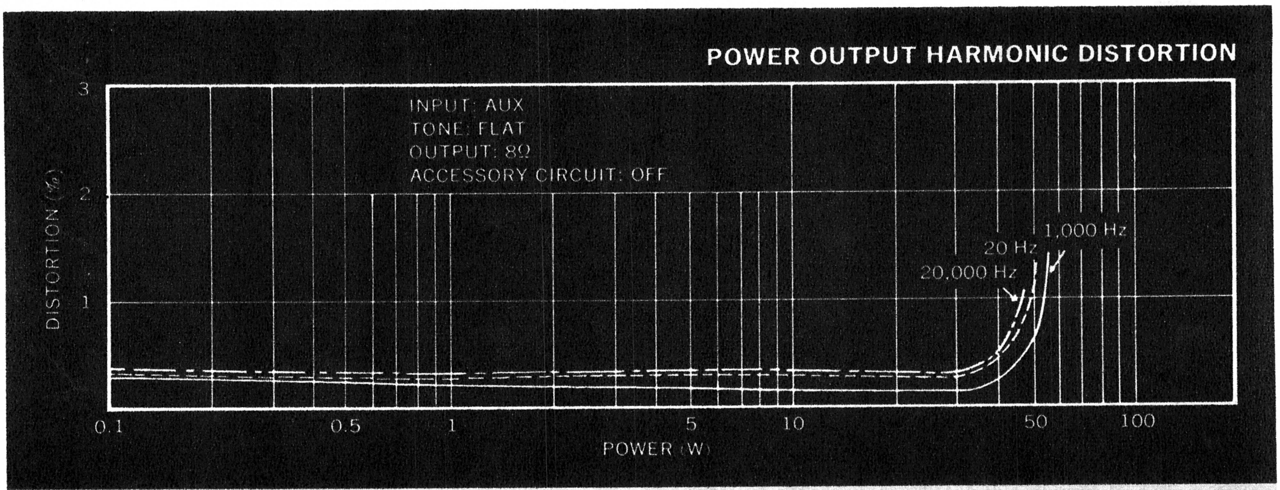
An "equivalent circuit" is the absolute converse of a block schematic. Whereas the latter tends to lump a lot of components together into a suitably branded rectangle or "black box," an equivalent circuit tends to break up individual components into their basic qualities. A mono magnetic pickup, for example, may be represented in an ordinary circuit diagram as a circle, with two leads running from it, and with an arrow drawn through it to represent a stylus.

But the equivalent circuit for a magnetic pickup might show it as an AC generator, an inductor and a resistor all in series, indicating that it can be regarded as a basic voltage or current generator whose output is modified by the inductance and resistance of its own internal coils. To be still more exact, a capacitor could be added to represent any distributed capacitance of the electrical system.

By allotting quantities to the internal L, C and R, it becomes possible to forecast, for example, what effect external loading may have on the performance of the particular cartridge.

At the other end of the amplifier chain, equivalent circuits are used quite a lot to analyse the operation of loudspeaker systems. In this case, the equivalent circuit is arranged to include additional electrical quantities — inductance, capacitance and resistance — which are equivalent in their effect to mechanical properties of the loudspeaker and its baffle system: Mass, inertia, springiness, damping, air volume, and so on. In fact, a detailed equivalent circuit for a loudspeaker system is a quite imposing array of circuitry, the working out of which represents a major engineering exercise.

An equivalent circuit which contains a preponderance of electrical quantities, substituting for mechanical quantities



Sansui lays it on the line

Look at that distortion curve.

It, better than pages of exaggerated advertising claims, tells the serious stereo fan something about the kind of engineering that has gone into building a receiver.

While this curve belongs to Sansui's Model 3000, it is the result of the same engineering, the same careful component selection, and the same precision fabrication that goes into every product carrying the Sansui name.

Sansui's line of audio equipment includes more than a dozen quality receivers at all power outputs — solid-states, tube types, single or multiple band tuners, amplifiers, amplifier-tuners—as well as matching speaker systems and stereo headphone sets.

Pick up specifications for any Sansui product and you'll find performance and distortion characteristics laid on the line as few stereo equipment manufacturers would dare.

Then listen to a Sansui at your dealer for a frank personal appraisal.

Sansui model 3000: Solid-State AM/FM Multiplex Stereo Receiver. Total output power: 130 watts. RMS power: 48/48 watts. Stereo RMS power: 45 watts x 2. Bandwidth: 20 to 20,000 Hz. Harmonic Distortion: less than 1% at all power levels.

Sansui®

SANSUI ELECTRIC COMPANY, LIMITED: 14-1, 2-chome, Izumi, Suginami-ku, Tokyo, Japan Tel: 328-0111

for purpose of analysis, is sometimes referred to as an "analog," a term which might seem less strange if we were to remark that a particular electrical circuit is "analagous" to a certain mechanical assembly or component.

★ ★ ★

I heard an artist recently who was playing what I think he called a transistorised accordion. Sometimes it sounded more like an organ than accordion. What gives?

Unless we miss our guess, the artist you heard was one of the Palermo Brothers, whose LP we reviewed on page 113 of the May issue. We didn't hear the instrument "in the flesh" but we did hear it on the record. From the tonal qualities, we'd say that it contained reeds for the basic accordion sound; either that or the electronic circuitry was remarkably well contrived to imitate them!

Equally, however, we felt that it probably contained a set of oscillators and multipliers, along with contacts under the keys for the organ sound. Either that or, once again, the electronic amplification had included some very effective filters to modify the sound of reed generators to tones more commonly associated with a conventional electronic organ.

However, the job of adapting an accordion to produce "organ" facilities would be simple compared with the latest creation of the Thomas Organ Company. in America. Showing remarkable ingenuity, they have built an organ-type transistor generator into the body of a guitar and adapted the string and fret system so that it will produce ordinary guitar sounds, when played in the conventional manner, but it will also key the transistor generator to produce electropically generated signals to a related pitch! The following description is by courtesy of "Electronics World."

"It is a combination of a six-string guitar and a miniaturised electronic organ that will operate with any amplifier with at least two inputs. It can also be used as a stereo unit, if it has the guitar portion plugged into one amplifier and the organ portion plugged into another.

"The instrument can be played as an ordinary electronic guitar, and the usual volume and tone controls are provided. An on-off side control brings in or cuts out the organ section. The organ can be played by depressing a string or strings, using one or both hands. It is not necessary to use the right hand unless it is desired to add some guitar melody or background. The organ sound is created when a string touches a fret (which acts as a contact) and sends the signal down the neck to the components inside the guitar body.

"The guitar-organ has two sets of tuning slots located on the back. One set is composed of six potentiometers which may be adjusted for fine tuning of the instrument. The other set of pots is used to fine tune the octaves.

"The guitar portion has three controls which are for volume, bass, and treble. The organ portion has fifteen controls which are for volume, repeat percussion, sustain, basic flute, and octaves, including six open-string buttons. These open-string buttons do three things. They can tune the organ to the guitar, supply a simple bass line, and sound the notes of the open strings. The guitar portion is powered by two six-pole magnetic pickups located between the neck and bridge.

"The guitar-organ can duplicate such tones and sounds as a church organ, rock-and-roll organ, baritone saxophone, low and high clarinets, bagpipes, flute, banjo, chimes, harpsichord, zither, and an oriental effect. The instrument requires no special technique except for the operation of some additional controls."

★ ★ ★

Is it possible to work out the proper connections for the reaction winding in a regenerative receiver, rather than having to change leads over?

Fortunately, yes. The basic requirement is that energy from the plate circuit must be coupled back to the grid circuit 180 degrees out of phase.

Let's start by assuming that the two windings (grid and plate/reaction) are wound on to the former **in the same direction.** In other words, holding the former upright, the wire should spiral upwards from the bottom of each winding **in the same direction.** This should hold, irrespective of the relative positions of the two windings.

If, now, the "top" of the main winding is to connect to grid, the "bottom" of the reaction winding will have to go to plate — and vice versa.

The most common way of winding a small coil for a regenerative receiver is to wind the larger or "grid" winding nearer the bottom of the former, with the smaller "reaction" winding spaced about 1/8 inch above it and continuing in the same direction. From the bottom, the connections would then run: Earth, Grid, Plate, Reaction Capacitor (or B-plus).

If, for any reason, the reaction winding were put on in the reverse direction, the connections would become: Earth, Grid, Capacitor, Plate. In this case, the necessary change in phase would have been effected, not by connecting the active valve elements to opposite ends of the relevant windings, but by reversing the directions of the windings themselves.

When reaction (or feedback) is derived from the cathode rather than the plate circuit, it is important that the cathode and grid signals be **in phase.** This being so, if the grid goes to the top of the main winding, the cathode should equally go to the top of the feedback winding. More commonly, the cathode is simply taken to a tapping on the grid winding, a turn or so from the earthy end. This is usually more convenient physically and it satisfies the stated requirement that the cathode and grid signals be in phase.

These rules hold, irrespective of whether the detector valve is a triode or a pentode.

They also hold for transistors in the normal common emitter configuration. Thus, where reaction involves a separate feedback winding in the collector circuit, the base and collector must connect to opposite ends of their respective windings, assuming the windings to be in the same direction.

Similarly, emitter and base signals must be in phase for regeneration to take place.

Available from all good Hi-Fi stores, the latest

SHURE

SME precision pick-up arm

This model is now fitted with an improved dynamic damping system. The tracking error is lower which is an advantage especially when using an elliptical stylus.

Now supplied complete with 4 feet of miniature coaxial connecting lead with a capacity of less than 27 pf per foot, terminated with shielded output socket and SME precision Phono Plugs. Also features S2 ultra lightweight shell, finger lift and light alloy mounting hardware.

Model 3009/S2 suggested list price .. **$107**
Model 3012/S2 suggested list price .. **$113**

ACCESSORIES

S2 ultra lightweight shell	**$10.95**
Decca D3 Adapter	**$1.38**
Lifting Handle	**$1.00**
SME Phono Plug	**$1.00**

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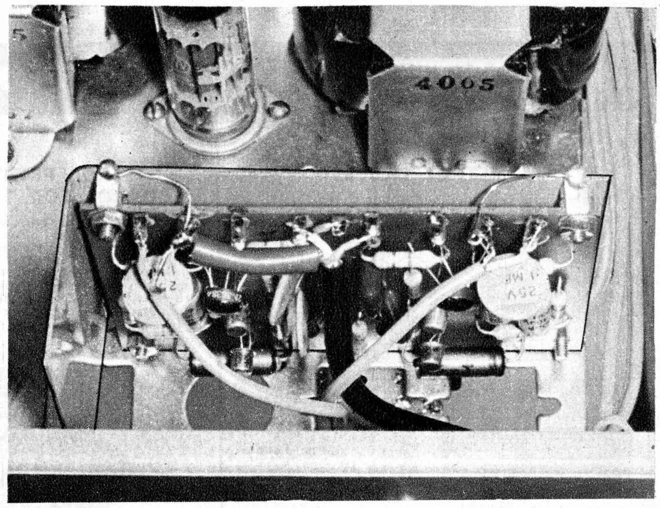
MAGNETIC PICKUP PREAMP FOR THE PLAYMASTER 118

When we presented the Playmaster 118 amplifier, last month, we indicated our intention of describing the addition of an in-built preamplifier, to allow it to operate from a high-quality magnetic pickup. We show how it can be done but, in so doing, revive some of the problems which can attend the construction of high-gain single-unit amplifiers.



This picture taken over the front of the panel shows the preamplifier, attached to its support and shield plate. Note that the input, output and supply connections are mounted uppermost and away from the basic chassis.

Superficially, the job of adding a solid-state preamplifier to the 118 looked to be a matter of pure routine and we initially approached it as such.

Because we knew that 7 volts or more DC would be available from the cathode circuits of the output valves, it seemed logical to settle for the silicon transistor preamplifier originally featured in the October 1965 issue. The preamplifier is capable of operating from a voltage of this order, at low current drain, and can provide a suitably high input impedance (with series input resistor) ample gain and the requisite RIAA compensation.

In addition, it has the advantage over our more recent preamplifier using field effect transistors that no adjustment or setting-up is required. Last but not least, the twin board, carrying both channels, seemed tailor-made for the space which had been reserved for it on the 118 chassis.

It did not take long to wire up and install the preamplifier and we would very much like to say that it worked fine from the outset; unfortunatley such was not the case. As the gain was advanced towards a usable level with a typical magnetic pick-up, the amplifier exhibited instability at high frequency, motorboating at low frequency and more than its fair share of hum. Our first problem was to discover whether the effects were interdependent or merely occurring simultaneously! By operating the unit from a supplementary power supply, experimenting with the connecting leads and terminals, and lifting the board away from the chassis, we were able to determine that the effects were, in fact, quite unrelated and that we were faced with the need to find three separate cures for three separate problems.

Not surprisingly, the motorboating turned out to be a feedback loop from the output valve cathodes to the preamplifier supply line. With the volume and bass-boost controls turned full on, the gain at low frequencies is so high that a scheme which is neat and convenient in other circumstances turned out to be just too touchy with the augmented 118. With sufficient decoupling, it was, in fact, possible to stabilise the system but, at such a cost and with such a loss of voltage, that it became more logical to go over to a zener stabilised supply, fed from the main HT line.

In so doing, some of the argument in favour of the silicon preamplifier was weakened but only in part; low voltage zeners are cheaper than high voltage zeners, and the commitment for resistors would likewise be less to regulate a lower order of current. The further advantage of not having to adjust the operating conditions also remains.

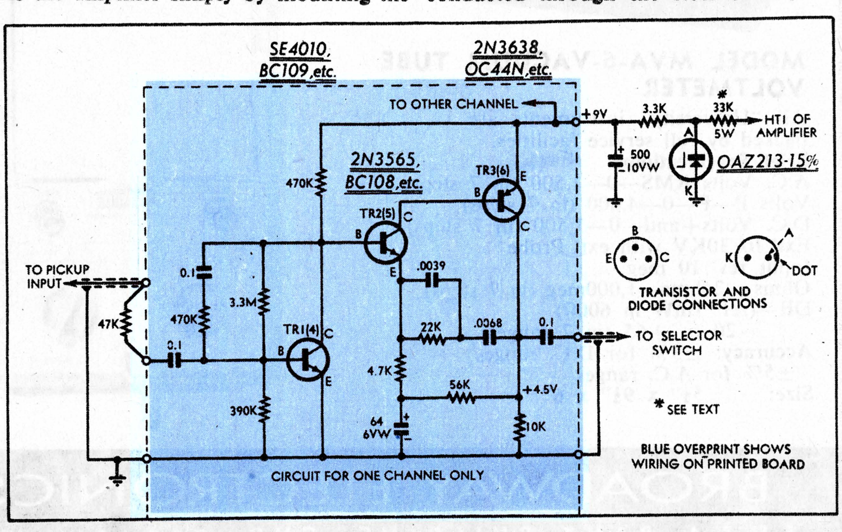
So point number 1 emerged; The way to supply such a preamplifier is by means of a dropping resistor and zener from the HT line, with an extra resistor and by-pass capacitor to complete the low voltage supply.

The high frequency instability turned out to be due to proximity of the pick-up input connectors to the wiring of the output stages and, in particular, to two components on the rear end of one tag-board —a 4.7K resistor and a 100pF capacitor. In the original version of the 118, with about 100mV sensitivity for a ceramic pick-up, the juxtaposition of the input and low impedance output wiring posed no hazard but it is a different matter when the input sensitivity gets down to below 5mV.

In fact, we found it possible to stabilise the amplifier simply by mounting the 100pF capacitor on the same pair of lugs as the 4.7K resistor and bridging the lugs formerly allotted to the capacitor with an earthed busbar. However, rather than rely on a half-measure, we decided to install a small shield plate to isolate the pickup connectors from adjacent wiring. Two methods suggest themselves: One is to cut a small shield from a scrap of tinplate and solder it to the two lugs just mentioned, earthing the assembly with a short busbar; alternatively, the end of the tagstrip can be cut off and a shield plate bolted to the chassis.

Point number 2, therefore, is that the input wiring and connectors must be fully shielded from the pickup cartridge through to the input connectors of the preamplifier board. Once again what is "near enough" for a 100mV sensitivity is not good enough for less than 5mV.

If the hum problem could have been as easily solved as the first two, we would have been very happy, but such was not to be. Basically the problem was found to stem from stray fields from the power transformer—to some extent conducted through the steel chassis but



Circuit details of the preamplifier. The section picked out in blue represents connections and components mounted on the printed wiring board. Other wiring has to be added, as described in the text.

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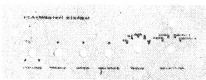
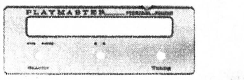


(A) 115-117 Amps.



(B) 111-114 Tuners.

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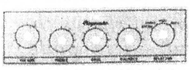

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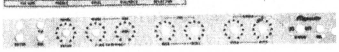

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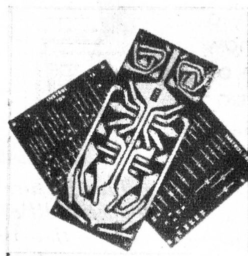

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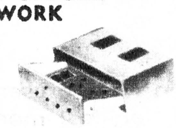

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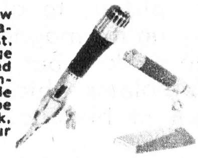

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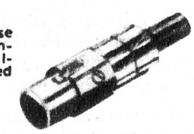

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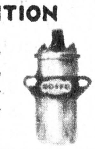

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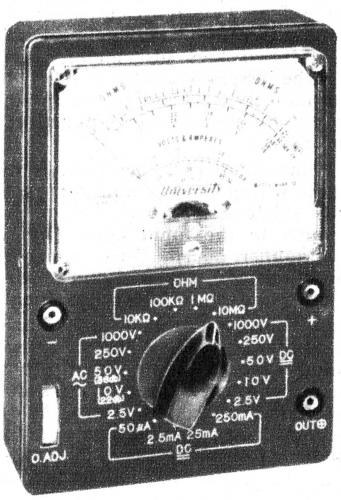

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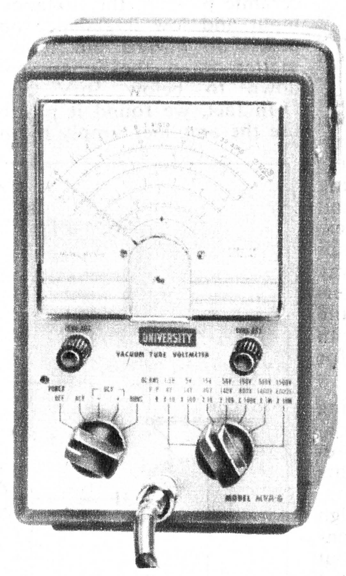

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otherwise in the free space surrounding the transformer.

Fortunately, the position selected for the preamplifier—mounted vertically in the opposite corner of the chassis—is about the optimum and, by proper arrangement of shielding and earth returns, it is possible to get the amplifier virtually hum-free.

But herein lies the rub. Before the amplifier can be of any use, pickup leads have to be brought to it and the approach can only be through the fields from the power transformer. Ordinary shielding offers little protection against magnetic hum fields and the hum level is likely to rise with connection of the input leads.

Unfortunately, the effect is likely to be rather random, depending on the particular transformer used and the length and routing of the input leads.

We pulled all the tricks we knew in trying to solve this one, while still retaining the original power transformer—but with only very limited success. One such trick was to isolate the runs of shielded wire to the two halves of the cartridge, eliminating the link at the cartridge which is often used to join the two earth pins. This precaution obviated what can be an earth loop remotely bridging the inputs to the two channels.

Under these conditions we were able to get the hum down to where it was barely audible at ordinary listening distances, with the amplifier set up for fairly loud volume and partial bass boost, with a typical "5 millivolt" magnetic cartridge. For some, this might be good enough, but it would not meet the situation where the loudspeakers had a peak at 50Hz. or where the listener was fond of bass boost or given to listening critically for hum.

So to lesson number 3: You don't try to mix on the one chassis a high-gain preamplifier, full bass compensation and a power transformer with unrestricted leakage field!

If you have already built the 118 Playmaster and want to add a magnetic pickup preamplifier, we suggest that you mount the preamplifier up under the motor board and close to the base of the pickup. For good measure, it can be partially enclosed in an earthed cover-plate bent up from tinplate or aluminium. Take the leads from pickup to input and run shielded leads from the output lugs of the preamplifier to the input connectors already on the amplifier and wired for a ceramic pickup. The positive supply line can be run from the amplifier supplying the requisite few volts from the zener and filter to the preamplifier. Since the signal approaches the amplifier at more like 200mV than 5mV, hum injection into the leads from the power transformer is no longer significant.

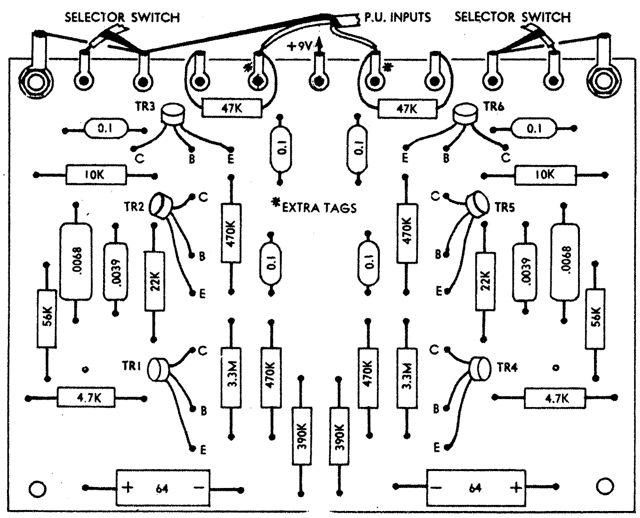
The ultimate answer to the problem, however, is in the use of a power transformer fitted with a copper strap to short the stray field. Very fortunately, Ferguson Transformers were able to supply us with their type PVD111FT, the "T" indicating shorting strap. Electrically it has the same specifications as the PF1555 or PVD111F, etc., used in the original amplifier. Most likely, other manufacturers will make available their own version with shorting strap and we are going to suggest to suppliers that this modified line of transformers be supplied for the appropriate units in the Playmaster range, whether or not they are intended for ultimate use with a magnetic pickup. The difference in cost is not all that much.

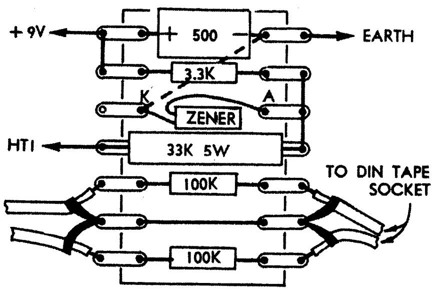
In this case, the drop in hum level was little short of sensational. With the wiring otherwise undisturbed and the pickup connected, the hum level dropped to the point where it was below the prevailing noise level of the preamplifier, with volume and bass controls at full on and a sensitivity of better than 2mV for full output! With the tone controls at level and the volume control set for loud listening level, the hum and noise was quite inaudible.

To our great relief, an amplifier, which had started out as just about as unsatisfactory as it could be, had ended up with a performance which was quite outstanding.

So much for the story behind the amplifier, which we have told in detail for the sake of the lessons which it contains. Now for a few paragraphs about the actual construction of the preamplifier.

At right is the wiring diagram for the preamplifier, as originally described in the October 1965 issue and constructed on the 65/p10 wiring board. This design calls for the addition of two lugs to accommodate the 47K input series resistors.





The supply components for the silicon preamplifier can conveniently be mounted on a short length of tagstrip and held under the same bolt, behind the control switches, which currently supports one of the existing tagboards. Alternatively, a longer tagboard can be installed in the first place.

As mentioned earlier, the preamp was originally featured in the October 1965 issue. This article described in full the operation of the preamp., which could also be adapted as a preamp for tape heads.

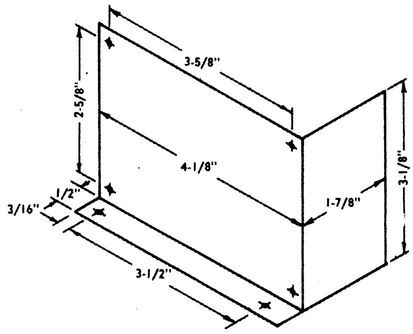
Assembly can begin with the wiring of the printed board. When mounting components on the board, do not bend the pigtails too close to the component body or bend them too sharply, since this encourages fracture. Care should be taken, also, not to overheat the components, and particularly the transistors, during soldering. Since the original preamp board did not have provision for mounting the 47K input resistors, we mounted an extra two solder lugs on the board, one on each side of the 9-volt supply terminal, as shown in the diagram. Do not overlook these two resistors, since they ensure suitable loading for the cartridge.

Initially, we used several low voltage ceramic capacitors in the prototype preamp but we do not recommend their use as they turned out to be a potential source of microphony. Low voltage polyester capacitors do not suffer from this trouble and are a better choice in very low level stages such as these.

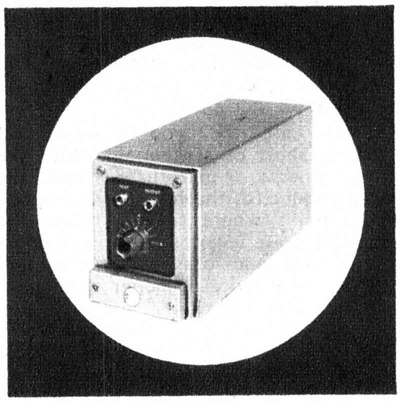
The printed board is mounted on a steel plate with dimensions as in the diagram and bent up from 20-gauge steel. We had to drill two extra 1/8in diameter holes in the chassis to mount the plate which is set back 2¼inches from the front panel. The board is secured to the plate with 1/8in screws and spacers or spacing nuts to provide adequate clearance between board and plate. Make sure that these rear nuts or spacers do not foul the copper pattern near the corners.

Referring to the photograph of the

(Continued on page 174)



Here is the bracket which we bent up to support the preamplifier. We suggest that it be made from 18 or 20 gauge steel, as used for the chassis, to help sidetrack any stray field in the plane of the board.



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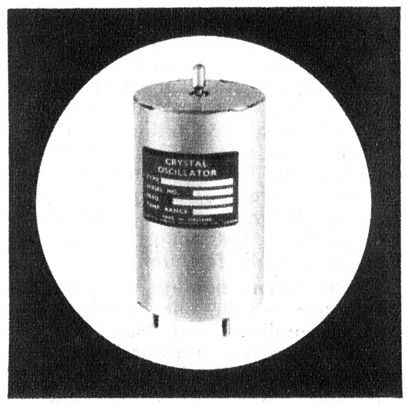

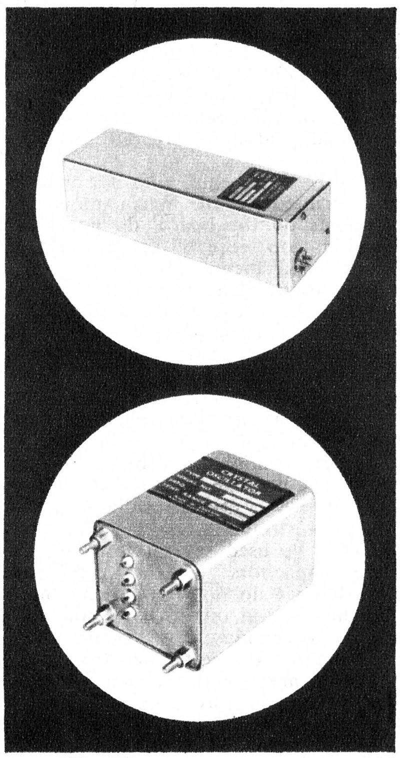

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The Serviceman

NED KELLY — TV SERVICEMAN!

My two main stories this month are, I am sorry to say, classic examples of service tactics which, at the very least, must be regarded as highly suspect. Coming, as they do, hard on last month's experience along similar lines, they force me to wonder just how widespread are such malpractices, and whether there is some kind of resurgence.

My first story concerns a complaint about a TV set suffering from low sound output. The history of the fault, as I finally pieced it together, was quite enlightening, in view of what I subsequently discovered.

It seemed that, about two years previously, the set's sound had failed completely. The people had called in a serviceman, who, after examining the set, had diagnosed a condition which, according to the owner, would have been quite expensive to repair. Exactly what this condition was supposed to be, or whether it was ever precisely described, I was unable to determine after such a long time. Neither was I able to determine whether the serviceman simply described it as expensive, or quoted a figure but, either way, he succeeded in frightening the customer off having the job done.

Then the serviceman suggested that, if they didn't want to pay for an expensive repair right then, he could make a temporary repair which might serve them until they were ready to have the job done properly, assuming they were prepared to accept a reduced performance. So this was agreed to. The serviceman made his temporary repair, collected his fee, and went on his way.

As it turned out, the reduced performance was a marked drop in available sound level in a set which was not renowned for its reserve in this regard, even in the best circumstances. More precisely, the level now available was just about sufficient under ideal conditions, i.e., a reasonable level from the transmitter and with everybody watching the program maintaining a strict silence. Even then it was sometimes a strain.

But the owner and his family tolerated this for two years, so effectively had they been frightened off by the "expensive repair." Finally, he could stand it no longer. As far as he was concerned the TV set had long since ceased to be a source of entertainment and had become simply one of irritation and annoyance. He made up his mind to have it fixed, no matter what it cost. And so he sought my aid.

I was rather intrigued by the story. I couldn't imagine what kind of sound fault could involve such a high level of expense, but was prepared to learn if it really was something unusual. On inspection, the set behaved very much as the owner had described it, although what sound there was was perfectly clean.

The set was a fairly old model, and a little unusual in regard to the sound channel. Instead of the more conventional triode pentode valve as a complete output stage, it employed a 6AU6 and a 6AQ5. On the other hand, it used only one stage in the sound IF system.

As far as the video section was concerned, everything seemed to be working fine. There was plenty of signal, a good reserve in the contrast control, and no sign of snow. I formed the opinion that, whatever the trouble was, it was unlikely to be in the common sound and video stages, but was much more likely to be in the sound IF or audio system. Well, at least that narrowed the field considerably.

First I tried new valves throughout, but this made no difference. I withdrew the chassis to the point where I could reach the sound section and went right over all stages with a multimeter. All voltages came up within a few per cent of the figures on the circuit; no future there.

Then I probed the grid of the 6AU6 with my finger via the blade of screwdriver. The speaker blurted obligingly, but I sensed that it wasn't as loud as it should have been for a pair of pentodes. So it looked as though the trouble was in the audio section. Thus encouraged, I went over the stage again with the voltmeter. I found nothing new as far as voltages were concerned, but I did notice that the 6AU6 screen resistor looked a bit dark on it, as though it had been overloaded at some time.

This didn't seem very relevant, because the screen voltage was normal, but it did suggest that this was the area where the previous serviceman had worked. And if the screen resistor had been overloaded it almost certainly meant that the screen bypass had broken down. So, for want of a better approach at that moment, I took a closer look at the screen bypass.

And then I spotted it. The pigtail from the bypass came close to, but did not touch, the terminal on the socket. What was more, it had clearly been left this way, rather than simply come adrift. Unfortunately, the placement of it and other components was such that the break was not readily visible until I started probing. Naturally, it didn't take a Sherlock Holmes to deduce that the capacitor would turn out to be shorted. So, in fact, it proved to be.

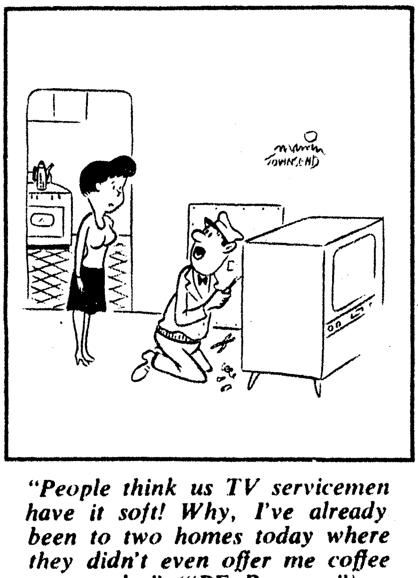
After that, it was plain sailing. It took only a few minutes to select and fit a new capacitor, whereupon the sound came through at full bore; something the owner hadn't heard for so long that he had forgotten how a proper set sounded. It wouldn't have taken much talking on my part to convince him that it was "better than ever."

But what was the story behind this story? Why had the previous serviceman acted as he did? The most generous suggestion I can put forward was that he just didn't have a suitable capacitor in his kit at that moment, and concocted the "expensive repair" story to cover up. But such a theory leaves a lot of things unexplained. For example, if the real problem was a shortage of a suitable part, he could have made almost any excuse—or even told the truth—to explain the need for delay and second trip. I doubt if the owner would have minded so long as his set was repaired at a reasonable cost.

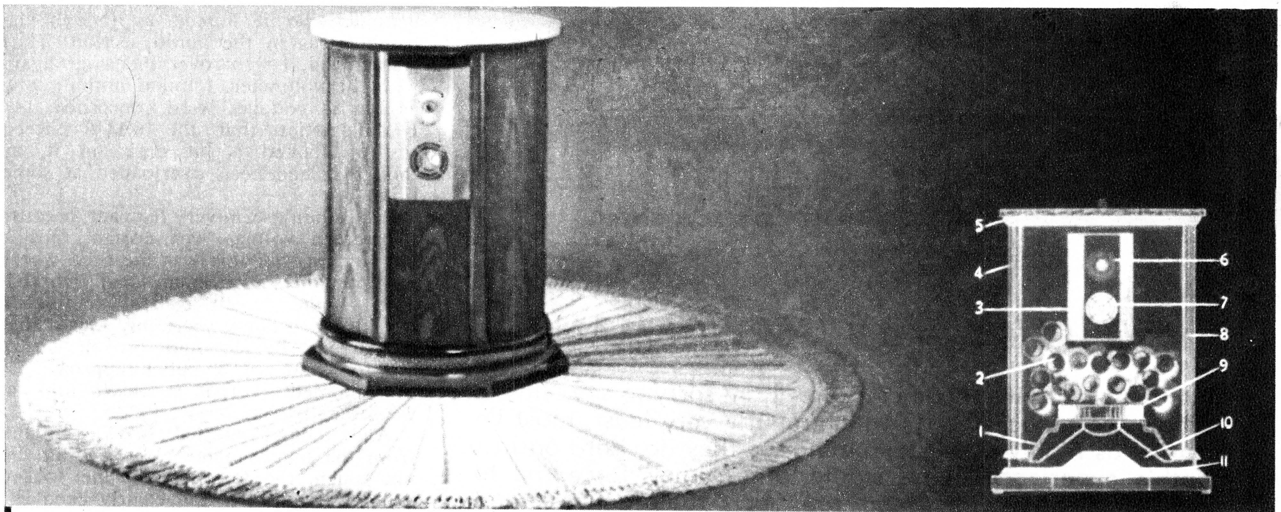
Frankly, I just can't buy such a story. As far as I'm concerned, it was a straight out attempt to "take" the customer. The "expensive repair" was a try-on; a feeler to see how the customer reacted. Had he shrugged his shoulders and said, "Do what's necessary," the serviceman would have taken it as a go-ahead to load the job for as much as he felt it would bear. Doubtless, he would have taken the chassis away "to make it look good," and kept it for a suitable period for the same reason.

But when the owner flinched he had another trick up his sleeve. No doubt to discourage the owner from calling in another serviceman, he made a good fellow of himself with a "generous" offer to effect a temporary repair, most likely reasoning that the owner would weaken after a week or two of indifferent sound, and call him back to finish the job.

Unfortunately — for him — he overplayed his hand. So effectively did he paint the picture of an expensive repair that the owner not only waited much longer than he would have thought possible but, when he did decide to do something about it, he elected to call in someone else.



"People think us TV servicemen have it soft! Why, I've already been to two homes today where they didn't even offer me coffee or cake." ("PF Reporter").



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Model 9000M outstanding features:

1. 15" mass loaded woofer with floating suspension and 4" voice coil.
2. Sound absorbent rear loading.
3. Die-cast mid frequency-high frequency full dispersion acoustic lens.
4. Hand rubbed satin walnut finish.
5. Imported Italian Perlata marble.
6. Ultra-sonic domed tweeter.
7. Full presence mid range direct radiator.
8. Exclusive non-resonant rigidised heptagonal sonic column.
9. World's largest (18lbs) speaker ceramic magnet structure.
10. Front loaded Horn — 360 deg. aperture throat.
11. Complete symmetry of design with terminals concealed underneath.
12. Dimensions: height 29" — diameter 22".

TECHNICAL SPECIFICATIONS MODEL 808

Frequency Response
10—20,000 cps.*
Output Voltage
8.0 mv. per channel
Channel Separation
more than 30 DB
Compliance
8 x 10^{-6} cm/dyne
Tracking Force
1 to 6 grams
Stylus
7 mil. radius diamond
Terminating Impedance
47,000 ohms
Stylus Replacement
S 808/7RD Black
*Dynamic capability to 40,000 cps.

TECHNICAL SPECIFICATIONS

MODEL	888	888E	888P	888PE	888SE
Frequency Response	10-24,000† cps.	10-30,000† cps.	8-28,000† cps.	6-30,000† cps.	6-32,000† cps.
Output Voltage	8.0 mv. per channel	8.0 mv. per channel	8.0 mv. per channel	8.0 mv. per channel	8.0 mv. per channel
Channel Separation	more than 30 DB	more than 30 DB	more than 30 DB	more than 30 DB	more than 30 DB
Compliance	10 x 10^{-6} cm/dyne	12 x 10^{-6} cm/dyne	15 x 10^{-6} cm/dyne	20 x 10^{-6} cm/dyne	25 x 10^{-6} cm/dyne
Tracking Force	¾ to 6 grams	¾ to 5 grams	½ to 4 grams	½ to 3 grams	½ to 3 grams
Stylus	.7 mil radius diamond	.4 x .9 mil bi-radial elliptical hand polished diamond	.6 mil radius hand polished diamond	.2 x .9 mil bi-radial elliptical hand polished diamond	.3 x .7 mil bi-radial elliptical hand polished diamond
Terminating Impedance	47,000 ohms	47,000 ohms	47,000 ohms	47,000 ohms	47,000 ohms
Stylus Replacement	S888/7RD Brown	S888E/ERD Green	S888P/6RD Orange	S888PE/ERD Yelow	S888SE/ERD Blue

†Dynamic capability to 40,000 cps.

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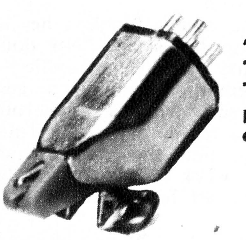

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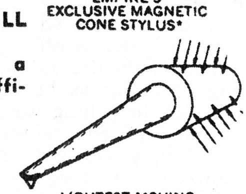

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But, compared with this "one that got away," I wonder how many people he has caught with the same racket? Ordinary people, people on wages, with a couple of kids to raise! People who, if faced with too many such demands, might well ask themselves whether they can afford to run a TV set. Small wonder there are people who regard servicemen as a bunch of crooks; who will put up with almost any kind of set performance rather than call one; who attempt to make their own repairs, no matter how ill equipped they are to do so; and who dig their heels in in protest whenever a serviceman wants to take the set out of the house, no matter how legitimate the suggestion may be.

The next story started late one Saturday morning, just as I was about to shut up shop. The customer, whom I had not seen before, explained that he was having trouble with his TV set. The story as he told it was somewhat garbled but, as nearly as I could make out, it had all started when his wife was dusting the set.

"I think she must have disturbed something," he went on, "because when I switched it on the next time the picture was all leaning sideways with black bars across it."

"Sounds like loss of horizontal hold." I replied. "Probably caused by your wife accidently disturbing the horizontal hold control. In fact, it shouldn't be hard for you to reset it yourself."

I went on to explain that, in the model set which he had described, the horizontal hold control was one of those located on the rear of the chassis. It shouldn't be hard, by adjusting it carefully, to bring the picture back into lock. The only snag was that it seemed that he had already tried this or, as he put it, he had " . . . tried all the knobs on the back, but this didn't fix it." He also intimated that he was anxious to get the set going that afternoon, as he wanted to watch the football.

This presented a problem. I was already committed for a couple of out-of-hours calls that afternoon, which I was undertaking as a special favour, and I didn't feel disposed to obligate myself any further. And even if I did, there was little chance that I could even look at the set before the football was over.

I explained this situation to the customer and suggested that, in view of the urgent nature of the situation, it might be better if he tried to find somebody else, better able to tackle the job immediately. I certainly wouldn't mind if he did. So he thanked me for what advice I had given him and we left it at that.

I was rather surprised, therefore, when I found him waiting for me when I opened the shop on Monday morning. But the real surprises were yet to come, and the first was contained in his opening remarks.

"I tried to watch the football on Saturday afternoon, but I got a bit jack of holding my head at forty-five degrees all the time, so I called in another serviceman."

Suddenly the penny dropped. My original diagnosis had obviously been quite wrong, though possibly justified by the garbled story I had been told. I had to clarify the situation before he went any further.

"Do you mean," I said, "that your set was delivering a recognisable picture?

IT IS LATER THAN YOU THINK!

The following story has been reprinted from the British "Electronics Weekly" 7/7/67, where it appeared in their "Talkback" column, conducted by one "Janus". It appealed to me because, like Janus, I too regard Joseph Roizen as one of my favourite speakers. (At a local I.R.E.E. meeting on one occasion his humorous anecdotes reduced at least one member of the audience to tears.) This story is well up to standard.

Joseph Roizen, of Ampex, one of my favourite electronic raconteurs, seldom misses an opportunity to enliven his talks with a seemingly inexhaustible supply of anecdotes — as from time to time I have noted.

At Montreux (International TV Symposium and Exhibition at Montreux, Switzerland), I gather, his description of the new Ampex slow and stop motion video disc recording unit (viewers are in for some shocks when they see some of the effects possible on this remarkable equipment) was subject to pretty severe cuts by the firm's legal department due to possible patent disclosures.

But this gave him more opportunity to slip in a few stories, one of which I abridge below.

This was about the electronics engineer working, a few years hence, on a gigantic new computer which if successful might result in electronics taking over the work of many millions of humans.

Although fascinated by the challenge of the computer, this prospect put the engineer into a quandary. Should he go ahead and so possibly deliver mankind to the machines, or should he throw over the whole project?

Worried, he returned home one evening to be met by a distracted wife who told him that the refrigerator was not working, and all the food was being spoiled. Dutifully, he checked all the fuses, the leads, the sockets, the connections. But everything seemed in order—yet the fridge remained warm.

Finally, he resorted to that mark of electronics desperation and gave it a hard kick. Sure enough, the fridge responded, and jumped into action.

The incident came as a great relief. No diagnostic computer, he felt, would ever have come up with this solution. Man was clearly destined to remain boss. He could go ahead with the huge computer project without qualms.

So light in heart, he set off next morning for his office. The lift was of the latest voice-controlled type. "Eighth floor," he commanded.

The lift ascended; stopped at the eighth; but then gently slid up to 8½ and firmly came to a halt; the engineer was stuck.

In surprise, he snapped at the control unit: "I said eighth floor."

"I know," replied the lift, "but this will teach you not to kick a fridge."

That the whole picture was simply tilted on it side?"

"Yes, that's right. And it had these black bars across the corner."

I will never understand why "black bars" seem to have such a morbid attraction for TV viewers. Yet it is a fact that any malfunction which reveals the edge of the picture is invariably described with all the emphasis on this fact. And it was the undue emphasis which this customer had put on the black bars which had deceived me in the first place. It was now obvious that all that was wrong was that the yoke had become tilted (a feather duster caught in one of the yoke leads?) and the appearance of the border across each corner was such an obvious thing — to me — that I wouldn't have expected anybody to mention it. The fact that it was mentioned, in a garbled way, led me to believe that the horizontal circuit had lost hold.

But the real surprise was yet to come.

"So I rang up another bloke, like you suggested, and he said he would come around straight away. And he did, too. He looked at the picture, then reached inside the back of the set and did something. The picture started to straighten up and I called out, 'That's better.' But it went back again immediately and the serviceman took his hand out and shook his head. 'Too big a job to fix here,' he said 'It'll have to go back to the shop to do it properly.'

"Well, I wasn't going to let him take the set away without knowing what I was up for, so I asked him what it was going to cost. He rocked me a bit when he said, 'Oh, about $20.' I mean, I don't mind a fair thing, but a tenner seemed a bit steep for what you reckoned would only take a few minutes. So I told him I'd think it over, thanks very much, and let him know later. He seemed a bit put out, but he didn't say much. What do you think?"

"I think," I replied. "that you acted with commendable caution. Come in here." And I led the way into the workshop. There was a set on the floor, with the back off and the yoke still to be tightened, and I switched it on. When the picture appeared I reached inside and gave the yoke a quarter turn.

"That the trouble?" I asked.

"Yeah! It was just like that."

"Well, all you do to fix it is this." And I demonstrated how the yoke was rotated to straighten the picture. I also showed him how to tighten the yoke clamp so that the trouble wouldn't happen again.

For several seconds he said nothing. Then, with considerable feeling, he muttered, half to himself, "And that — wanted to sting me a tenner, just for that."

As we walked back into the shop, he put his hand in his pocket. "What do I owe you for the advice?"

"Forget it," I replied. "This one's on me."

In other circumstances I might have

accepted a nominal sum for advice in lieu of a call, but I reasoned that a little free advice was the least I could do to try to restore some of the lost image which servicemen in general must have suffered.

In this case, I'm afraid, I can't even offer the benefit of a doubt. It was a straight out, calculated attempt to play the customer for a "sucker." And, had it not been for the perfectly innocent discussion which the customer had had with me before he called the other serviceman, this character might well have pulled it off. As it was, the customer had been conditioned to the idea that the fault was slight and the cure simple.

Later, when passing the customer's home, I took the opportunity to drop in and make sure that all had gone well with the repairs. They had, as it turned out, but the thing that struck me most was the unmistakable atmosphere of a couple of "battlers"; an atmosphere which must have been just as apparent to the other serviceman as it was to me. A young couple, obviously not long married, they were renting a "flat" — actually half an old house—while saving everything they could for a deposit on

WARNING

"There is a story going around Queensland that an electrician was electrocuted attempting to push in a contactor with a packet of ——— cigarettes.

"I have examined one of these packets and it appears to be coated with some kind of metallic film; at any rate, it is an excellent conductor. I think there may be other packets similarly coated.

"Even cigarettes using ordinary cardboard packets are usually wrapped in metal foil inside the packet. Not quite as dangerous as having the metal on the outside, I agree, but I feel that 'ELECTRONICS Australia' could serve the public interest by publishing the points outlined above."

—W.R.S. (Bundaberg, Q.).

their own home. So our smart friend did not have even the well-worn excuse that "the customer's got more money than I have."

These two stories, plus the one I told last month, are typical of many others which have forced me to the conclusion that there is an increasing amount of malpractice occurring in the service industry. What I was once inclined to write off as exceptions, caused by the odd "black sheep" which plagues every organisation, I am now forced to regard as an increasing and accepted trend in the industry.

As I commented in last month's article, I wonder how these types can sleep at nights. But morals aside — though I make no apologies for quoting moral values—surely this dishonest approach can only be a self-destructive one. And, unfortunately, destructive for the industry as a whole, rather than merely for those who employ such tactics. For this reason, it becomes the responsibility of all who believe in honest trading not only to follow this principle themselves but also to do everything they can to stamp out the dishonest practices of the unscrupulous get-rich-quick characters.

FREQUENCY AND WAVELENGTH

When one starts to work with radio, frequency and wavelength are among the first concepts to be encountered.

by John Schroeder*

To begin with, radio waves are a wave motion, in principle much like the waves caused by the wind on lakes and seas. We shall use the latter kind of wave motion in order to explain what is meant by wavelength and frequency.

Imagine that you are sitting in a boat and you hear the splashing sound of small water waves as they hit the side of the boat. You know from expirience that small waves hit the boat at a faster rate than larger ones. Suppose that you (with the help of a watch) determine how many splashes there are per second. That number is, then, the frequency of the waves, or the number of wave crests passing a fixed point — in this case the side of the boat — in one second. The distance between two crests is the wavelength (figure 1). Your experience tells you that big waves have larger wavelengths than small waves. A little thinking will reveal that waves with long wavelengths have a lower frequency (splash at a slower rate against the boat) than waves with shorter wavelength.

For example, think of ocean waves having a wavelength of some 40 or 50 meters from crest to crest rolling toward the shore. There may be only one such wave every ten seconds, and the frequency may therefore be said to be one tenth crest per second. Then think of small waves on the surface of a lake having wavelengths of one tenth of a meter. They hit a fixed point at a rate of 5 every second, in which case the frequency is 5 crests per second.

In broadcasting the radio waves are often compared to the circles of ripples on the surface of the water caused when a stone or similar heavy object is dropped (figure 2).

There is apparently a relationship between the wavelength and the frequency of the water waves. In broad terms, the relationship may be expressed as follows: **the greater the wavelength, the lower the frequency, and the smaller the wavelength, the higher the frequency.**

The same is true for radio waves, although they travel with far higher speeds than water waves. The speed of radio waves is the same as that of light waves, about 186,000 miles per second. The frequency of radio waves is not counted in a few waves per second passing a fixed point (for example, a radio antenna, figure 3), but in thousands or millions of waves per second. Furthermore, the frequency is not given in terms of the number of waves per second, but is expressed in the number of thousands or millions of **cycles per second.**

In ordinary circumstances, there is a fixed relationship between the wavelength of radio waves and their frequency. A given wavelength corresponds to a definite frequency, and vice versa.

* Adapted by arrangement from an original text by the author.

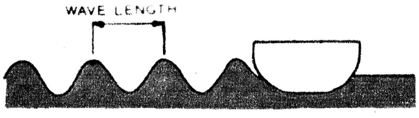

Figure 1: Normally, wavelength is considered to be the distance between the crests of the waves. Their frequency is the number of wavelengths that pass a point in 1 second.

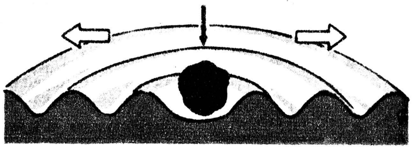

Figure 2: Radio-wave transmission has often been compared with dropping a stone into a pool of liquid. The waves go out in all directions, in concentric circles, like ripples on the water.

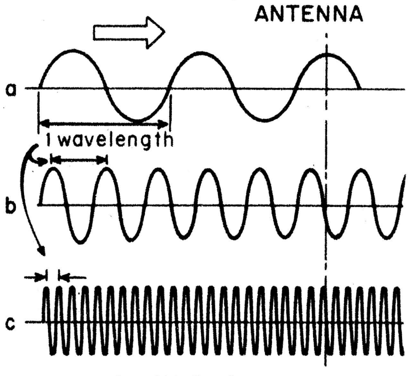

Figure 3: With longer wavelengths (a) the frequency is lower. As wavelength diminishes (b) and (c) frequency increases in a fixed relationship.

Radio waves may be identified either by their wavelength or by their frequency, both ways being equally valid.

What makes it possible to separate radio stations from one another in the receiver is that they transmit on different wavelengths, or at different frequencies. In the infancy of radio the wavelength concept was predominantly used to describe the radio waves transmitted. Today, the concept of frequency is being used more.

A significant factor in bringing about this change in custom is the fact that frequency is a natural term to use in connection with audio (or sound) circuits and it is rather cumbersome to think of transmitters operating on a certain wavelength but transmitting sidebands displaced from the carrier by certain frequencies. Equally, it is cumbersome to think of receivers processing a signal of a certain wavelength and recovering frequencies in the audio spectrum to operate the loudspeaker. It is much easier to think in terms of frequency right through the process — though, in fact, there was considerable resistance to the practice in the early days from those who had grown accustomed to wavelength terminology.

It is interesting to note, however, that wavelength terminology is often used in connection with transmitting and special purpose receiving antennas, because there is a basic relationship between the physical dimensions of an antenna and the wavelength of the radio frequency energy it may be designed to handle. For a somewhat similar reason, expressions of wavelength are frequently heard in the context of the very high frequency signals involved in radar, satellite and point-to-point communications. As often as not, these are referred to as "microwave" systems operating on a wavelength of so many centimetres.

Figure 6 shows at a glance the relationship between frequency and wavelength for waves used in communications.

The wavelength of radio waves is ordinarily expressed in metres. The frequency is expressed in cycles per second

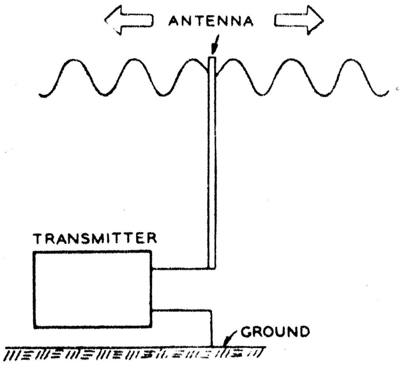

Figure 4: Radio waves leaving a transmitter antenna travel at more than 186,000 miles per second to the receiver antenna. This definite speed of propagation establishes the relationship between wavelength and frequency.

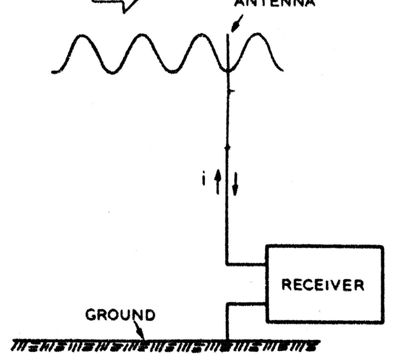

Figure 5: Passing the receiver antenna, the waves cause a signal to be generated in the wire. This signal is selected and amplified by the receiver circuits to make it strong enough to operate an earphone or a speaker.

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Further details—Page 43, March '66 "ELECTRONICS AUSTRALIA"

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Model Train control kit with SIMULATED INERTIA

Further details—Page 80, March '67 "ELECTRONICS AUSTRALIA"

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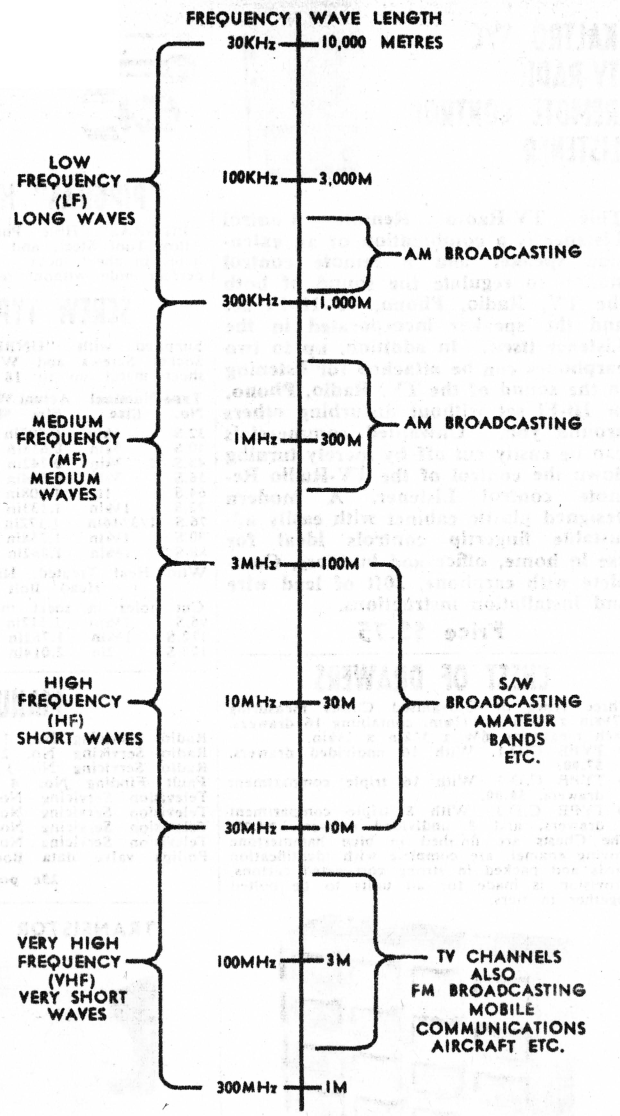


Figure 6: Depicted here is the terminology normally used to describe the major sections of the radio frequency spectrum between 30KHz and 300MHz. Most countries use an AM broadcast band and allocate TV channels in the VHF spectrum. Long - wave broadcasting is used in some countries, also FM broadcasting. There is a good deal of variation in the use of other frequencies.

Because the frequency of radio waves is so high, the unit **kilocycles per second** is also used, or popularly **kilocycles.** One kilocycle per second equals 1,000 cycles per second. (Compare the units kilogram = 1,000 grams; kilometre = 1,000 metres.)

EXAMPLE: 1.45 kilocycles per second = 1450 cycles per second: 0.15 kilocycles per second = 150 cycles per second: 174 kilocycles per second = 174,000 cycles per second, etc.

For still higher frequencies the unit **megacycles per second** is used, or popularly **megacycles.** One megacycle per second = 1,000 kilocycles per second = 1,000,000 cycles per second. Therefore, 15 megacycles per second = 15,000 kilocycles per second = 15,000,000 cycles per second.

Rules for converting wavelength to frequency and vice versa are set out below:

Frequency in Kcps = 300,000 ÷ wavelengths in metres

Frequency in Mcps = 300 ÷ wavelength in metres.

Wavelength in metres = 300,000 ÷ frequency in Kcps

Wavelength in metres = 300 ÷ frequency in Mcps

Frequency	Wavelength
30 Kcps	10,000 metres
100 "	3,000 "
300 "	1,000 "
1 Mcps	300 "
3 "	100 "
10 "	30 "
30 "	10 "
100 "	3 "
300 "	1 "

Kilocycles per second and Megacycles per second are abbreviated as kc/s (or kcps) and Mc/s (or Mcps) respectively. The following units refer to frequency.

1 cycle per second = 1 c/s (cps)

1,000 cycles per second = 1,000 c/s = 1 kc/s (kcps)

1,000 kilocycles per second = 1,000 kc/s = 1,000,000 c/s (cps)

1,000,000 cycles per second = 1Mc/s (Mcps)

Sometimes the letter "s" is arbitrarily omitted from the abbreviation. Thus in the same sentence we might have a reference to 60 cps and 10 Kc or 20 Mc, instead of 10kc/s or 20Mcs.

In fact, the cumbersome nature of the basic terms "cycles per second," "kilocycles per second" and so on, and the confusion that can arise over their contractions and abbreviations has been largely responsible for the recent widespread adoption of "Hertz," meaning "cycles per second." Metric expansions of the term become kilohertz and megahertz, and the abbreviations Hz, KHz and MHz.

The term cycles per second and its derivations are still legitimate because they express basic quantities. Use of Hertz simply achieves an economy of expression—though its ultimate adoption is being attended by the same pangs which years ago were apparent in the changeover from wavelength to frequency. In order to accustom readers to the term, Hertz is used throughout the remainder of this article.

Long, medium and short waves: Employing a suitable radio receiver one can tune in transmitters operating in the **long-wave** and **medium-wave bands.** The long-wave band covers radio waves having wavelengths between 2,000 and 670 metres (150 to 450KHz), the medium-wave band covers those between 600 and 190 metres (500-1,600 KHz). Many short-wave receivers can also be tuned to certain portions of the **short-wave band,** which covers waves between 100 and 10 metres (3-30MHz). The range between the long—and the medium-wave bands, 670-600 metres (450-500KHz), and the range between the medium- and short-wave bands, 190-100 metres (1,600-3,000 KHz) are reserved for other uses, such as radio-communication between ships on the sea.

In many ways the short-wave range is particularly interesting to the experimenter. Not only are there a large number of broadcast transmitters operating in the short-wave bands, but one may listen to various types of communication. For example, in the so-called **amateur bands** (see figure 7) one can follow the conversations and experiments carried on by amateurs. In addition, there are bands reserved for telegraph and telephony between ships, aircraft, etc.

Particular charm is given to the short-waves by their special propagation characteristics. Transmitters very far away may be received, even when using very primitive and inexpensive equipment. This naturally appeals to the amateur, who seldom has any surplus money.

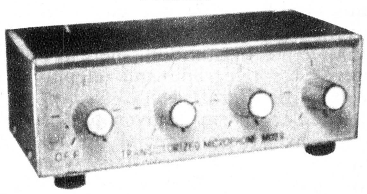
Ultra-short waves (VHF): In later years, the ultra-short waves have attracted more and more interest. Ultra-short waves are radio waves with wavelengths shorter than about 1-metre i.e. with frequencies higher than 300MHz. Broadcasting is taking place today in this range from frequency - modulated transmitters, as well as television transmissions. The FM broadcast transmitters in many countries are assigned wavelengths between 2.7 and 3.4 metres (88-108 MHz), while television transmitters are allocated to "channels" distributed between about 6.7 metres (45MHz) and 1.35 metres (222MHz).

PALACE 8-WATT STEREO AMPLIFIER

SPECIFICATIONS:
● Output Power: 8 Watts, 4 Watts per channel. ● Frequency Response: 60 to 15,000 cps ± 1db. ● Harmonic Distortion: Less than 3 per cent. ● Hum and Noise: 52 db below rated output. ● Sensitivity: Phono (Crystal) 100mV 250K ohm Tuner 100mV. ● Tube Complements: 12AX7 x 1, 30A5 x 2, 1S315 x 1 (Silicon Rectifier). ● Dimensions: 9¾in x 6¼in x 3in. ● Weight: 5.1lb.

Price $32.50

MODEL M6 FOUR CHANNEL TRANSISTORISED MICROPHONE MIXER



All four inputs accept standard two circuit Phone Plugs, while the output jack accepts a standard circuit Phone Pin Plug.

SPECIFICATIONS:
● Input Impedance: "Hi" Impedance for Crystal Microphone, etc. ● Gain: Approximately 6 db. ● Maximum Input Signal: 1.5 volts. ● Maximum Output Signal: 2.5 volts. ● Output for Minimum Distortion: 2 volts. ● Hum: 0. ● Battery: 9 volts.

Price $6.75

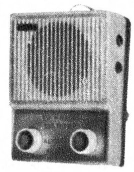
BELPHONE HOUSE TELEPHONE

Complete with batteries and 50ft connecting wire. May be used further apart if desired by using heavier connecting wire.
Colors Available—Ivory, Red and Black

$13.50 Set of two

Please Note: Clarence St., city, and Liverpool Stores are open Saturday mornings.

KALTRO SVC TV-RADIO REMOTE CONTROL LISTENER



This TV-Radio Remote Control Listener is a combination of an extension speaker and a remote control station to regulate the sound of both the TV, Radio, Phono, or Hi-Fi set and the speaker incorporated in the Listener itself. In addition, up to two earphones can be attached for listening to the sound of the TV, Radio, Phono, or Hi-Fi set without disturbing others around you. Unwanted commercials can be easily cut off by merely turning down the control of the TV-Radio Remote control Listener. A modern designed plastic cabinet with easily adjustable fingertip controls ideal for use in home, office and business. Complete with earphone, 20ft of lead wire and installation instructions.

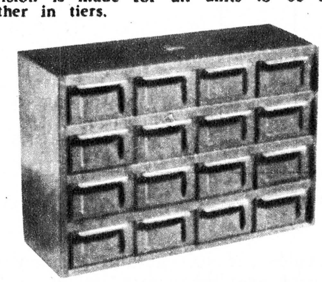
Price $8.75

CHEST OF DRAWERS

Three types of Galvanised Chests measuring 17⅛in x 6¾in x 11⅞in, containing 16 drawers, each measuring 6⅝ x 3¾in x 2⅛in.

- TYPE C.D.1. With 16 undivided drawers, $7.00.
- TYPE C.D.2. With 16 triple compartment drawers, $8.00.
- TYPE C.D.3. With 8 triple compartment drawers, and 8 undivided drawers, $8.00.

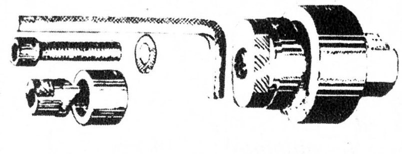
The Chests are finished in blue hammertone stoving enamel, are complete with identification cards and packed in strong corrugated cartons. Provision is made for all units to be bolted together in tiers.



CHEST OF DRAWERS TYPE C.D.4.

A 17⅛in x 6¾in x 11⅞in Galvanised Chest containing 4 full-length drawers each measuring 15¾in x 6⅝in x 2⅛in. Finished in blue hammertone stoving enamel. $7.00.

WRITE FOR FREE CATALOGUE AND PRICE LIST OF TOOL BOXES AND CHEST OF DRAWERS



"PIPGRAS" HOLE PUNCHES

"PIPGRAS" Hole Punches are made from Alloy Tool Steel, and cut clean and accurate holes in sheet metal. They make a smooth, perfect hole without reaming or filing.

SCREW TYPE, ROUND

Supplied with "UNBRAKO" High Tensile Socket Screws and Wrenches. Cut holes in sheet metal up to 18 gauge.

Type No.	Nominal Size	Actual Size	Water Pipe Size (I.D.)	Pilot Drill Size	Price Each
32.S	½in	0.507in	—	¼in	$2.17
40.S	⅝in	0.618in	¼in	5/16in	$2.17
48.S	¾in	0.742in	⅜in	5/16in	$2.80
56.S	⅞in	0.884in	½in	⅜in	$3.80
64.S	1in	1.008in	—	⅜in	$4.10
72.S	1⅛in	1.133in	¾in	⅜in	$4.53
76.S	1/3/16in	1.172in	—	⅜in	$4.53
80.S	1¼in	1.258in	—	⅜in	$4.97
88.S	1⅜in	1.382in	1in	7/16in	$5.97

With Heat Treated, High Tensile Steel Hex. Head Bolt and Nut.

Cut holes in sheet metal up to 16 gauge.

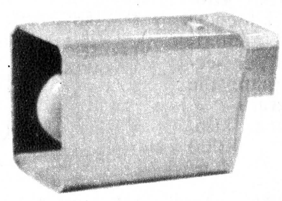
Type No.	Nominal Size	Actual Size	Water Pipe Size (I.D.)	Pilot Drill Size	Price Each
96.S	1½in	1.512in	—	9/16in	$6.68
112.S	1¾in	1.762in	1¼in	9/16in	$7.60
128.S	2in	2.014in	1½in	9/16in	$8.33

MANUALS

Radio Servicing No. 1	$1.00
Radio Servicing No. 2	$1.75
Radio Servicing No 3	$1.50
Fault Finding No. 4	$0.88
Television Servicing No. 1	$1.50
Television Servicing No. 2	$1.50
Television Servicing No. 3	$1.00
Television Servicing No. 4	$1.25
Philips valve data Book New Issue	$3.00

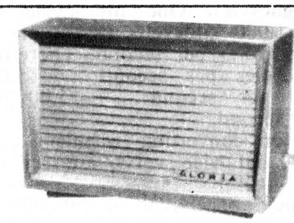
25c postage.

TRANSISTOR MEGAPHONE



Miniature and handy. Can be used anywhere by anybody. Megapet PM-77 Transistor Megaphone . . . Transistors: 3 pcs. Battery: Dry Cell (UM-)3 8 pcs. Acoustic Range: 100 metres. Height: 98 mm. Width 68mm. Overall length: 170 mm. Weight: 550 g. (with batteries).

Price $18.90



MODEL SB-401 PLASTIC CABINET

Complete with 4in speaker.

Price $4.00

GENERAL ACCESSORIES

Trade Enquiries Invited

116-118 Clarence St., city, (Clarence St. City and Rhodes Stores are Open on Saturday mornings)
443 Concord Road, Rhodes. 73-0211 — 7 Pirie Street, Fyshwick, A.C.T. 90035

A READER BUILT IT!

Circuits and devices which we have not actually tested in our laboratory but published for the general interest of beginners and experimenters.

POWER SUPPLY FOR CAR RADIOS ETC.

"Here is a description of a high current low voltage power supply intended for use as a bench supply in the workshop. It is suitable for driving the older vibrator type car radios, of which there are still a number in use.

"I decided to build this because I was sick of continually charging a battery under the bench, which was usually flat after each use. No doubt other technicians have experienced this trouble.

"Since building it I have found other uses for it, such as battery charging, for testing small car refrigerators which are now readily available on the Australian market, and small transistor radios. In these and other general workshop uses it has proved itself after nearly a year of operation, in use almost every day.

"Construction and operation is as follows:

"Power passes via an ON-OFF switch to power transformer T1. This came from an old radio, and has taps from 110V to 250V. It is used as a Variac to supply T2. A 6.3V winding in the same transformer is used to supply a panel indicator lamp.

"Transformer T2 was wound for the job, using the core and primary winding of an old TV transformer. All windings other than the primary should be removed, the number of turns of the lower voltage secondaries being checked in the process to arrive at the 'turns per volt' design figure for the transformer. Thus, a 6.3V winding which consisted of about 33 turns would suggest a '5 turns per volt' design. The new winding should supply 12V centre tapped.

"Current rating is about 8A and this determines the gauge of wire required. One authority suggests 1200 circular mils of cross sectional area per amp or, for 8A, about 10,000 circular mils. This would correspond to approximately 10 B & S or 12 SWG. This figure probably errs on the conservative side. In any case, the largest gauge that can be used will depend on the available 'window' space inside the core.

"This transformer feeds a bridge type rectifier consisting of four heavy duty diodes, type BYX20/200, mounted two each to two Mullard type 40 P4CB heat sinks. These provide sufficient cooling under maximum load.

"The filter capacitors must be at least 4200uF each to permit testing hybrid and all-transistor type car radios. The choke which I used was a K type Rola speaker transformer with a 15 ohm/3.5 ohm secondary, the whole secondary winding being used. Anything smaller will not handle a heavy load without overheating.

"An oscilloscope test with the supply delivering 6A showed it to be near enough to pure DC. Only a slight ripple was apparent. This supply could, of course, be regulated but I have found this unnecessary as the voltage remains fairly stable even under considerable drain. Metering of the supply is optional.

"The cost of this supply could be kept under $20 and for the serviceman it's a time saver."

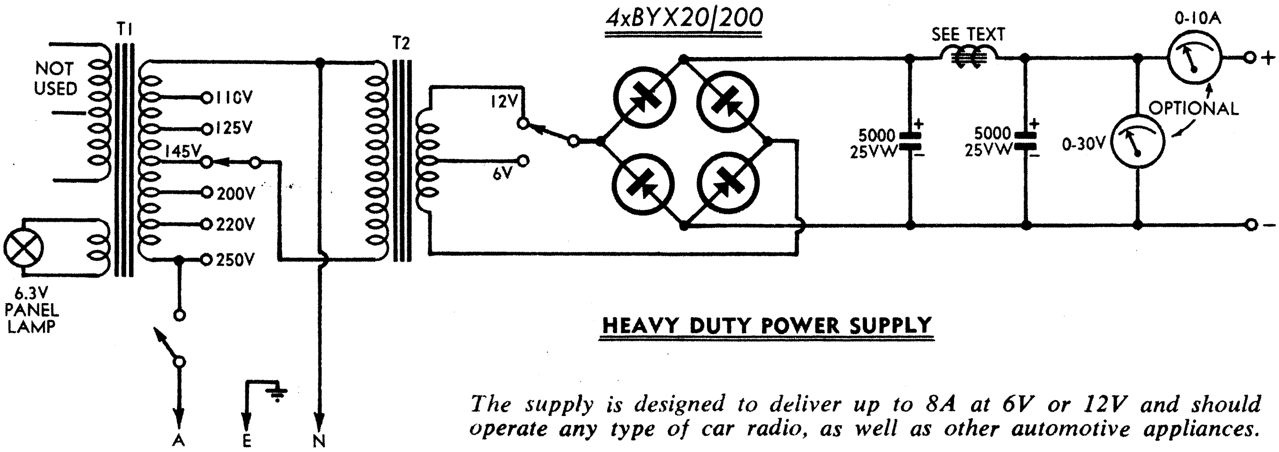
(From Mr R. A. Bayley, 27 George St., Thirroul, N.S.W.)

EDITOR'S NOTE: There are some points to be considered by anyone likely to build a unit of this kind, but who may not be able to copy the published design exactly.

One concerns possible overload of and damage to the rectifiers in the event of a short circuit across the output — as from a faulty vibrator in a car radio. In the circuit as published the resistance of the choke is probably sufficient to protect the diodes, but this may be lost if one attempts to fit a bigger and better choke.

Secondly, while it is natural to fit as much "C" as possible in the filter circuit, in the interest of better filtering, there is a definite limit to what may be used for the first filter, directly after the rectifier. In its discharged state this represents a short circuit, leaving only the impedance of the transformer to limit the rectifier current to a safe value. Again, it is probable that the transformer used in the original has a high enough value to limit the current to a safe value, but this may not be automatically so for other units. Unless the situation is known precisely, additional "C" should be added to the second filter only.

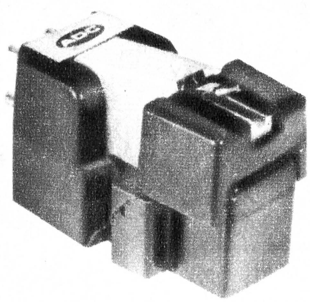
Finally, an RF by-pass in parallel with the second filter may prove beneficial, particularly when the electrolytic begins to age a little. This should be a non-electrolytic capacitor of about .1uF, or larger if this can be provided economically. The need for such a capacitor would be indicated by any tendency to RF instability in a receiver, particularly if this was absent on battery operation.



HEAVY DUTY POWER SUPPLY

The supply is designed to deliver up to 8A at 6V or 12V and should operate any type of car radio, as well as other automotive appliances.

A SCIENTIFIC BREAK-THROUGH IN DESIGN

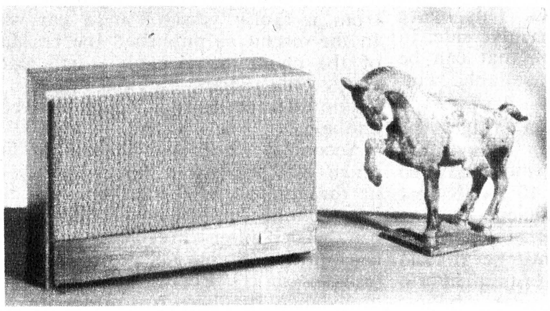


The new ADC-10E/II Cartridge

Stylus mass could not be further reduced, as, thanks to the INDUCED MAGNET ARRANGEMENT, the Mark I has a moving mass dramatically lower than that of its closest competitors. Equally, it would have been pointless to increase an already fantastically high compliance of 35 c.u. It was not easy to further improve such an advanced design, BUT IT HAS BEEN DONE BY INCORPORATING A SIGNIFICANT, PATENTED REFINEMENT OF THE ARMATURE SUSPENSION. This new version traces the most complex and difficult passages so superbly that the mind can only grope clumsily for words of sufficient praise. You simply have to experience such unparalleled tracing ability and listening quality for yourself.

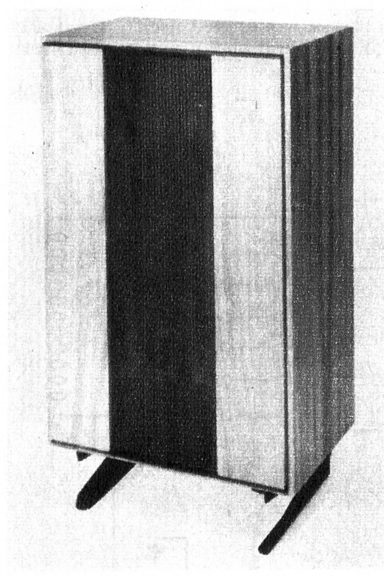
There is no doubt, that the new ADC.10E Mark II represents the state of the art in high fidelity cartridges and its genuine, effortless reproduction is a new experience in sound quality. The performance is, indeed, second to none.

KEF LOUDSPEAKERS



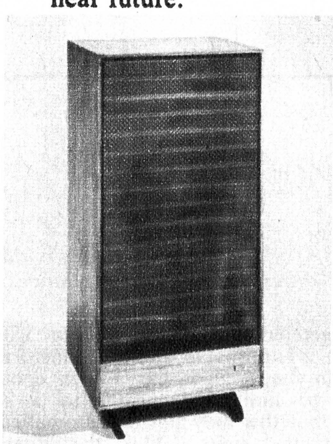
The CRESTA

The response to our June and July advertisements was outstanding. Very soon, these world-famous speakers and speaker-systems will be available on the Australian market. Our waiting lists are long, but the supply position will dramatically improve in the near future.



The no-compromise, professional CARLTON

KEF



The CONCORD, reviewed in Hi-Fi News, March 1967.

We sincerely suggest that you audition **KEF SPEAKERS** before buying any other brand and if you are not in a particular hurry your patience will be well rewarded. To say that these superb and truly remarkable speakers are well worth waiting for would be an understatement. Watch for further announcements!

J. H. REPRODUCERS PTY. LTD.

293 HUNTINGDALE ROAD, CHADSTONE, VICTORIA. 3148 TELEPHONE 277-3066

Exclusive Australian Representatives of ADC, U.S.A. and KEF, U.K. and Makers of the J.H. Synchronous Turntable.

LESS NOISE, MORE DYNAMIC RANGE

In terms of background noise, modern discs and tapes are a far cry from those of the immediate post-war era but engineers — and critical buyers — are not yet satisfied. The battle against background noise still goes on, as evidenced by recent developments.

By Neville Williams

Noise problems begin at the original recording site. Particularly with large orchestras and large organs, the recording equipment has to be taken to the performance, rather than vice versa. Microphones have to be placed so that they will "hear" the performance as a whole, involving something of the acoustic environment. All too readily does this mean that the microphones will pick up extraneous acoustic noise at sufficient level to be heard through the quieter musical passages. Largely, this is a problem of time, site and microphone placement and the problem is being eased by new auditoriums which have been designed with an eye to their likely use for recording and broadcasting.

However, this is only the beginning of the problem. In practical recording systems, the amplitude at which the strongest signals which can be recorded is limited by the onset of distortion in the medium — non-linearity in the magnetic or optical pattern, loss of tracing ability in a stylus system, etc. The weakest signals have to compete against the inherent noise in the system — grain structure in the film or tape, surface characteristics of discs, hiss and hum in the associated amplifiers etc. In practice, the ratio of the strongest to the weakest signals which can be successfully (and commercially) recorded, referred to as the "dynamic range" of the system, is smaller than is called for by many musical performances. As a result, either the musical performance itself has to be modified to the restrictions imposed by the recording system, or else the dynamic range of the signals actually recorded has to be compressed by manual or automatic manipulation of the recording amplifier gain.

In considering the problem, it is insufficient to think just in terms of the original process of committing the performance to a master recording. In practice, the signal on the master recording has to be transferred several times before it reaches the copy which a customer will actually buy. Each copying or "dubbing" process is likely to apply slight further restriction to the dynamic range, notably by adding a quota of noise to compromise signals which are at too low a level. The master recording, therefore, has to be engineered not as an end in itself but as the first link in a fairly long chain.

Many techniques have been employed in an effort to reconcile the naturally wide dynamic range of musical performances to the limitations of practical commercial recording systems. Typically:

(1) Setting the gain of the system to cope well with low level passages and manually lowering the gain in anticipation of loud passages.

(2) Setting the gain to cope well with loud passages but advancing it in anticipation of low level passages.

(3) Using automatic compression techniques, normally to restrict the amplitude of large waveform peaks.

(4) Use of multiple microphones and complex console techniques to pick up total or individual sounds from suitable distances.

(5) Use of highly sophisticated amplifiers and recording medium (e.g. magnetically coated 35mM film stock) to preserve the highest possible dynamic range during the early stages of recording.

Apart from the limitations of human operators, methods (1) and (2) in particular call attention to themselves in the final reproduction by their effect on the total noise and reverberation ambient of the particular performance. Anyone who has listened at all critically to reproduced sound will, many times, have noticed changes in background as some unseen and perhaps otherwise forgotten operator has turned a fader up or down.

Automatic compression or peak limiting (3) minimises this latter problem but all too easily introduces a distortion component in the waveforms upon which it operates. Nor is the process readily reversible; it is not easy to restore accurately the waveshape or to recover the original dynamic range, particularly for large orders of compression. This complicates any idea of using a compressed signal for the early recordings and transfers, and of restoring it, at least in part, on the final customer recording.

By using and especially combining techniques (4) and (5) records can be made having very low noise and a dynamic range with peaks of such amplitude that they are likely to exceed the tracking abilities of even high quality magnetic pickup cartridges. However, it is not always practical to use these techniques and the recording industry still has to face two rather harsh realities:

(1) Neglecting pops caused by surface effects, many discs are still quieter in terms of "white" noise than the master tapes from which they were taken, and

(2) While pre-recorded tapes on the market are free from clicks and pops and have better stereo separation than the equivalent discs, their signal/white noise ratio is markedly poorer under similar playing conditions.

While commercial tapes and discs are both well able to meet the standards required by the present-day mass market, engineers and hi-fi conscious listeners alike are aware of these limitations and there is a constant challenge to overcome them. The aims may be expressed in three ways, all of which are really variations on the one basic theme:

(1) To achieve wider dynamic range from the ultimate consumer recording, minimising the problems of peak amplitude on the one hand and background noise on the other.

(2) To do so with less expensive recording and copying facilities.

(3) To increase the tolerance of the recording chain as a whole to signals of all amplitudes, so that the final result will depend less on critical setting up of gain and levels.

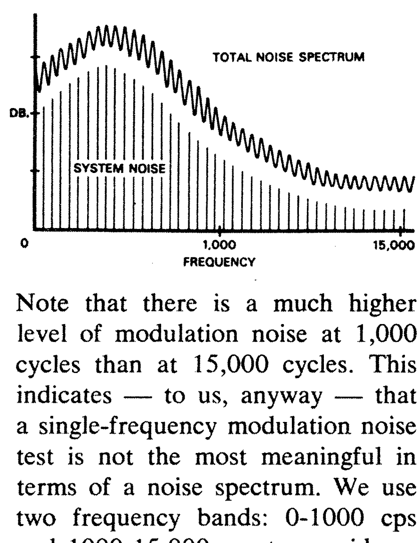
In the face of this situation, audio engineers and hi-fi enthusiasts alike are likely to show ready interest in any system claiming to increase the dynamic range and or reduce background noise, particularly if it is applicable to existing equipment. But, equally, they are likely to be dubious of any claim to have solved the problem in any easy way.

And they have certainly been dubious about the "Dolby Audio Noise Reduction System" which was announced some time ago. Until proved otherwise, "The Dolby" was fated to be treated as just another black box, surrounded by just another set of extravagant and unlikely) claims. Gradually, however, the impression has grown that the Dolby unit may be worth a second look, even if

Some plain talk from Kodak about tape:

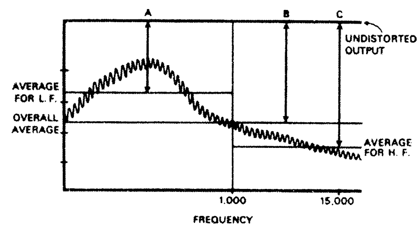
SIGNAL-TO-NOISE RATIOS, SATURATION OUTPUT AND UNIFORMITY

Modulation noise, jocularly referred to as "mud", is the most discriminating test of sound tape. A close look at the "mud" that forms the lower limit of the dynamic range reveals that the recorder's electronic and transport systems are responsible for the lion's share of noise. By noise spectrum analysis we can examine noise level (in dbs) at every frequency. Look at the graph below.



Note that there is a much higher level of modulation noise at 1,000 cycles than at 15,000 cycles. This indicates — to us, anyway — that a single-frequency modulation noise test is not the most meaningful in terms of a noise spectrum. We use two frequency bands: 0-1000 cps and 1000-15,000 cps to provide us with a low-frequency s/n ratio and a high-frequency s/n ratio.

This is a much tougher test than using a single frequency or integrating the entire spectrum. The following chart shows the effect.



Notice how taking a modulation noise average for the entire spectrum results in a figure that is lower than the L.F. figure and higher than the H.F. figure. How is this important? Here's how. If we use the modulation noise level from the low-frequency range (A) we get a poor dynamic range and signal-to-noise ratio. We get a moderate one from the average (B) and a great one from the H.F. figure (C). There are those who would measure from C and publish this as the performance of their tape. Let them. We measure low-frequency and high-frequency mud and still come up with a dynamic range that is often as much as 6.5 db better than conventional tapes in the L.F. area. 1.5 db better in the H.F. range — even when they use their lowest figure. We are pretty proud of our silence. Shhhhh is the word at Kodak.

Here's how we test for saturation output. We increase the input and monitor the output. When we reach a point where the output no longer increases with the input, we know that we have reached saturation, which is the point where every available oxide particle in the layer has been polarized.

As a test it does not have earth-shaking implications, but it does tell us about how many oxide particles are present, which is actually a measure of the thickness and particle density of the oxide layer. We get a figure in db and can use it to accomplish some pretty tight quality-control over oxide coatings.

We're pretty proud of that control, too . . . and with good reason. We make our tape so that we are well within the rigid specifications we publish. At Kodak, uniformity is a way of life. When we say sensitivity varies no more than ± ¼ db within a roll and ± ½ db from roll to roll, we *really mean it!* This is only the uniformity of the low-frequency signal. We check high-frequency uniformity as well. In that way we can keep close tabs on the uniformity of the oxide thickness and the uniformity of the oxide surface.

But uniformity is more — much more — than just a word. It has plenty of practical significance. For instance, uniformity within a roll assures constant frequency response, balanced output for all recording tracks, and freedom from "drop-outs". Reel-to-Reel uniformity permits inter-reel splicing without obvious changes in the level of the recorded signal. And for the professional, it means that he can find one optimum bias level for all rolls of tape.

You can do all these things with Kodak tape. In fact, we're so proud of the uniformity of our product we put our name on it . . . right there on the back of the tape!

K1449 **Motion Picture and Education Markets Division KODAK (Australasia) PTY. LTD.** Kodak

only because it manages the job of compression and decompression far more effectively than earlier circuitry. Writing in "Hi-Fi Stereo Review" for July, '67, John Milder reflects some of this recent enthusiasm. What follows is a condensation of his article.

Over the past few months, recording engineers and executives have been talking enthusiastically about "the Dolby," a device whose purpose is to reduce the background noise of master tape recordings. According to reports from the recording industry, the new device has important implications not only for professional applications, but for the ultimate quality of records to by played in the home. And from the evidence now supplied by the first halves (input and output) of the Dolby's operational cycle, and that all tapes and recorders using the Dolby system are completely interchangeable. In the process, it assures that the print-through noise that often accumulates during the storage of tape will be greatly diminished when the tape is put through the second (or playback) half of the cycle.

As far as the recording industry is concerned, the big advantages of the system are, first, the tremendous basic gain in signal-to-noise ratio (10 to 15dB, depending on the frequency range) and, second, the ability to re-record ("dub") tapes for processing with virtually no discernible increase in noise from copy to copy.

I came within a foot or two of a loudspeaker. In a direct comparison with the best record I know of, derived from a 30ips master tape recording on half-inch tape, instead of the usual 15ips recording on quarter-inch, the difference in favour of the new records was very audible. And after several hours of listening and cross-checking, I became convinced that virtually all of the "material noise" that I—and you—have been hearing from recent discs is actually the result of tape hiss in the master recording. (This is not to say that there can't be a bad pressing made from a Dolbyised master tape.)

The absence of tape hiss is not nearly as important for most listeners

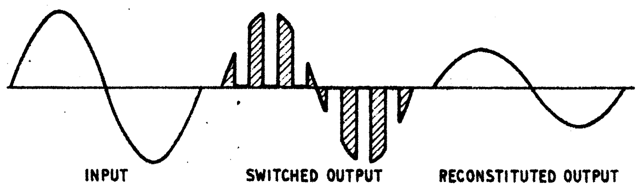


Figure 1: A system developed by Pye transforms the audio envelope temporarily into a pulse train. In this form the signal can be modified by varying pulse width.

two "Dolbyised" records produced in this country (one from Vanguard, one from Nonesuch), the reports seem to be justified.

I feel these two records represent one of the most clearly audible breakthroughs in sound quality in many years. That is not the kind of statement I thought I would be making when given these recordings to evaluate, but the more I have listened to them, the more I have become convinced that the new Dolby system will become a sine qua non for recordings of serious musical material until some entirely new recording medium arrives.

The Dolby A-301 Audio Noise Reduction System is a simple-looking "black box" designed for connection to the inputs of a tape recorder during recording and the outputs during playback. The invention of Ray M. Dolby, an American audio engineer now living in England, it is designed to combat not only the high-frequency tape hiss added to any original signal during tape recording, but also many other kinds of background disturbances (including print-through echo, crosstalk, and scrape noise) that inevitably appear during the tape-recording process.

The new Dolby system does nothing at all to loud signals. Instead, working in four separate segments of the frequency range, it begins by boosting the level of all signals below a certain strength just before they are recorded. Then, during playback, it cuts these boosted signal areas back to their original level, and, in the process, reduces to the same degree any noise that has been added to the signal during the recording process.

This "backward" process has been attempted before, but the Dolby system succeeds where previous gadgets have not, and for two reasons. Firstly, by handling four separate frequency bands and secondly because its operation is perfectly symmetrical in its boosting and cutting of signal strength.

It means that a tape can be stored for months or years between the two

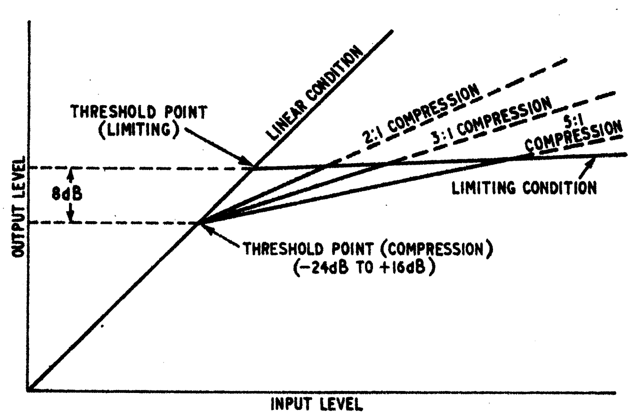


Figure 2: Illustrating the performance characteristics of the Pye unit operating in linear mode, with three orders of compression or as a peak limiter with a 20:1 compression ratio above the limit threshold.

Can you hear a 10 or 15dB reduction in noise? Yes, you can, and the results are far more dramatic than you would guess. The outstanding characteristic both of Vanguard's and Nonesuch's first Dolbyised records is clarity — to an almost incredible degree. It is not simply the absence of tape hiss or other noises during a quiet passage heard in a quiet room, but the absence of all sorts of effects, unidentifiable in themselves, that add a slight haze to the reproduction of musical instruments. The effects of print-through, crosstalk, and other kinds of middle- or low-frequency noise are unquestionably subtle individually or in combination, but there is nothing subtle about their absence.

Aside from clarity there is also a definite decrease in the amount of distortion perceptible in loud passages. This is a function of the engineer's ability, with the Dolby, to set peak recording levels a bit lower without having to worry about noise in quiet passages. And it is highly noticeable in the undistorted burr of the trombone in Vanguard's L'Histoire du Soldat and the unfuzzed fortissimo of the piano on the Nonesuch recording.

As for tape hiss as such, for all practical purposes it simply isn't there. Late at night, in a quiet room, at a listening level louder than my neighbours will freely tolerate, I couldn't hear the slightest sound of hiss until as the question of overall clarity. But it does become important to those who own very-wide-range loudspeakers.

Finally, it is worth emphasising that the Dolby system appears to add no distortion of its own worthy of the name. No spurious effects of any kind appear to be added. Aside from Mr Dolby's thoroughgoing engineering, this seems to be a function of the system's doctoring of only the lowest signal levels.

The two recordings referred to by John Milder are:

RACHMANINOFF Sonata in C Minor for Cello and Piano, Op. 19. KODALY: Sonata for Cello and Piano, Op. 4. Harvey Shapiro (cello); Earl Wild (piano). NONESUCH H 71155.

STRAVINSKY: L'Histoire du Soldat, Madeleine Milhaud, Narrator; Jean-Pierre Aumont, the Soldier; Martial Singher, the Devil. Gerald Tarack (violin); Charles Russo (clarinet); Theodore Weis (trumpet); Julius Levine double bass); Lorin Glickman (bassoon); John Swallow (trombone); Raymond Desroches (percussion); Leopold Stokowski cond. Vanguard VSD 71165/66 two discs.

Whether John Milder's enthusiasm for the Dolby system is justified, only time will tell. It could be that some of the advantage in the records reviewed is stemming from improvements in other directions, or from special attention which detail often receives when

something new is afoot. Again, Dolby may not have a mortgage on the ideas behind his unit and other engineers and companies may well have their own developing answers to the whole problem.

As a matter of interest, in this connection, the May 1967 issue of "Industrial Electronics" refers to a system which the Pye Company in England has developed to compress audio signals fed to sound transmitters, to obviate the effects of inadvertant overmodulation on peaks.

The article refers to the known limitations of the type of compressor in current use, using non-linear elements to reduce gain on unduly large peaks of signal:

(1) Distortion tends to be excessive if the system operates at too high a signal level, especially with large orders of compression.

(2) If signal levels are restricted to minimise distortion, signal/noise ratio becomes a problem.

(3) It is difficult to define precisely the characteristics of non-linear circuit elements and to provide their converse where required.

(4) Distortion components introduced by normal compression methods can themselves become modulation components, so that an attack on one problem introduces another.

In the new Pye system, the audio envelope is interrupted at a frequency much greater than the highest audio frequency being handled. This interrupted waveform, as illustrated in figure 1, is subsequently passed through a low-pass filter, which removes the pulse component and reconstitutes the original envelope, with minimal distortion. If no other circumstances intervene, the system is quite linear in its operation and output very closely approximates input.

However, at the point in the chain where the signal is in the form of discrete pulses, it is possible to modify their energy content in terms of pulse width and according to a predetermined mode governed by signal amplitude or pulse height. Any such modification of pulse width appears as a modification of output waveform relative to input waveform.

Figure 2 indicates the claimed performance parameters. Unlike the Dolby unit which leaves the peaks unaltered and elevates the low level signals above the noise, the Pye unit achieves a similar end result by elevating the entire recording level and operating to compress the louder signals. Alternatively, it can operate in a "peak limiting" mode, similar to existing peak limiters used by broadcast stations.

In compression mode, the unit operates above a defined pivot or threshold point with selectable conditions ranging from linear (no compression) to ratios of 2:1, 3:1, 5:1.

As a peak limiter, the threshold is raised by 8dB but the compression ratio is increased to 20:1.

While the whole of the discussion is in the context of compression and/or peak limiting for broadcast transmitters, its relevance to the recording situation is evident. Again, only time will tell whether the new generation of records and tapes on the market will be "Dolbied" or "Pyed."

CARTRIDGE REPLACEMENT GUIDE LISTS 6,600 TYPES

The job of selecting a replacement cartridge for a difficult to get type has been made easier for audiophiles in U.S.A. The Singer Products Company, of New York, has produced a cartridge replacement guide which lists 6,600 cartridges for which its Sonotone range of cartridges can be used as replacements. All data has been printed out of the company's computer. The cross references are held in the computer's memory bank, and are up-dated monthly.

The guide is divided into two main sections. Section 1 shows all data for the use of Sonotone cartridges to replace competitive cartridges, with the latter alphabetically. Section 2 gives compiled data for using Sonotone cartridges as original equipment and as replacement equipment for radiograms and players. Other information included is a comprehensive index to enable the user to quickly locate the page on which a cartridge is listed; a cartridge specification guide for performance comparison; and photographs of all Sonotone cartridges to simplify indentification when the type number is not known.

KNOW YOUR GRAMOPHONE*

A plain man's guide to records and reproducers

By JOHN BORWICK, B.Sc.

PART ELEVEN — LOUDSPEAKERS

The subject of loudspeakers is rambling and at a designer's level, complex. However at our, mainly practical level, it will be enough to look at just a few of the construction aspects. Ultimately, a loudspeaker is a source of sound waves and, since we hope that these will be "musical" sounds, it is natural to compare the loudspeaker with musical instruments.

String, wind and percussion instruments all vibrate—when they are bowed, plucked, blown or struck—and their vibrations set the air into a sympathetic to and fro motion which spreads outwards at about 760 miles per hour. Each type of musical instrument has a limited band of frequencies to cover and is carefully built to impart a traditional tone colour to the sounds it emits.

A loudspeaker is meant to reproduce the sounds of all musical instruments. It should therefore be capable of vibrating and radiating at all frequencies. It should also be equally efficient at all frequencies and, even more difficult, it should introduce no characteristic tonal quality of its own.

How loudspeakers work: Moving coil (electromagnetic) loudspeakers are so much in the majority, that I shall follow the usual practice of describing this type first and treat other types—including the important electrostatic loudspeakers—in a brief coda.

Figure 1 shows the outline of a typical drive unit. The voltage appearing across the amplifier output terminals is applied to the ends of the coil. In the absence of any signal, the front and back suspensions hold the coil accurately in the annular gap between the magnet pole pieces. When current flows, the coil is subjected to the well-known electromagnetic force and will tend to swing back and forth in step with the half cycles of the alternating current signal. We have therefore achieved the first part of our electro-acoustic conversion and produced a vibratory movement corresponding to the signal to be reproduced.

It is now necessary, however, to cause this vibration to set a substantial amount of air in motion. This is the function of the cone. It is large enough to couple the oscillations of the coil, which is mounted at the cone apex, to the air—producing a train of alternating compressions and rarefactions. The cone should be light enough to be easily driven, other important characteristics being its stiffness and the flexibility and damping properties of the periphery surround.

The need for a baffle: Setting aside for the moment the problems of making the loudspeaker equally responsive to all frequencies, we can examine the way sounds will be radiated. Assuming that the cone is completely stiff and that the surround is 100 per cent compliant, the system will move backwards and forwards like a piston (see figure 2a).

Notice that the cone is actually a double radiator. At the same time as one train of alternating pressures is pushed out by the front of the cone, a similar train is emitted by the back. There is the important difference too that the front and back radiations are always half a cycle out of step (180 deg. out of phase). Therefore, we must expect serious cancellation effects due to interference between the two waves.

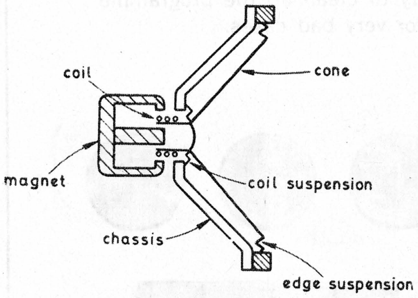


Figure 1: Moving coil loudspeaker, showing the most important construction features.

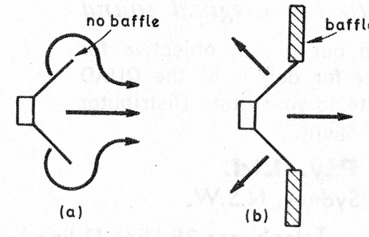


Figure 2: Need for a baffle: (a) without a baffle, back radiation can bend round to the front; (b) a baffle can prevent this interference except at the lowest frequencies.

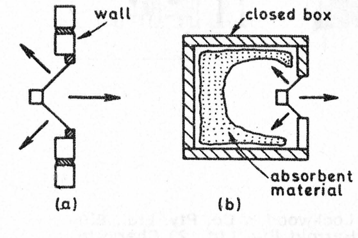


Figure 3: Infinite baffles: (a) mounting in a solid wall; (b) a totally closed box.

At the sides, this cancellation will be more or less complete: at the front, due to the screening effect of the cone itself, the cancellation will be very much less at middle and high frequencies. But the low frequency (long wavelength) sounds can bend round the cone and so even here we get serious interference—at all frequencies below that for which the wavelength is roughly equal to the cone diameter. It is possible to extend this screening effect to lower frequencies by fitting a baffle (see 2b). Excellent results can be obtained down to say 120Hz, with a baffle about 36in across. Lower frequencies than this need impossibly large baffles.

Infinite baffles: One solution, attractive in its theoretical simplicity, is to mount the loudspeaker in an infinitely large baffle. This will keep the two waves apart and allow the low frequency performance, as heard by a listener at the front, to extend as far down the musical scale as the mechanical system can go. The back radiation is lost, of course, though it is possible to visualise a loudspeaker built into the wall dividing two rooms (see figure 3a). The music could then be enjoyed in two rooms at the same time. Using the wall or even the door, of a large cupboard has also been tried successfully. The door should be fairly well sealed, of course, and the cupboard must be large (and preferably contain hanging clothes, etc., to break up and absorb any internal resonances).

Talking about the true infinite baffle now takes us to the class of, often quite small, cabinets which are euphemistically referred to as "infinite baffle" enclosures. An example is shown in figure 3b and it will be seen that the baffle is indeed infinite in that the box is totally enclosed so that none of the back radiation from the cone can escape. Unfortunately, a closed box will always act as a resonator—like the body of a violin or 'cello—and specific frequencies will be emphasised out of all proportion. (There will be resonant modes associated with each dimension of the enclosure and its total volume.) It is to cut down these resonances that, as figure 3b shows, infinite baffle enclosures must be heavily lagged with sound absorbent materials. In fact, it is quite usual to fill the enclosure completely with absorbent. This has the effect of reducing the sound velocity and so increasing the apparent box volume.

Another aspect, which I have not so far touched upon, is that the loudspeaker coil/cone assembly will itself have an inherent resonant frequency. This is determined by the mass of the system and the stiffness of the suspension and is the familiar base resonance frequency quoted in loudspeaker specifications. Now, clearly, in an airtight box the stiffness of the enclosed air will add to the effective stiffness of the speaker drive unit and the effect of this is to push up the overall resonance by an octave or more.

This is a severe drawback and, to counteract the bass loss which this entails, infinite baffle loudspeakers are generally fitted with unique new types of drive unit. These have very compliant, floppy surrounds, to give extra low initial resonant frequencies—of about 25Hz instead of the usual 35-65Hz—and ingenious coil centring devices to allow extra

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"long-throw" vibrations and so restore some of the bass efficiency. Not surprisingly, these special units tend to be expensive, but the growing demand for ultra-compact loudspeakers to give stereo in a reasonably small space has led to their adoption by most manufacturers.

Bass reflex enclosures: Before the advent of stereo, when it was necessary to accommodate just one loudspeaker, the bass reflex system was in vogue—and is still preferred by many people whose rooms can take two decent sized cabinets.

Figure 4 shows the basic construction of a reflex enclosure. Instead of being suppressed, the back radiation is folded back and allowed to radiate from a carefully dimensioned port. The cabinet and port dimensions are worked out together so as to produce a resonating enclosure tuned to the resonant frequency of the drive unit. (Well, it is the enclosed volume of air that really matters: any reasonable combination of length, breadth and height to give the required volume will do.) When this is done properly, the effect is to give just the right phase shift within the box so that the sound radiated from the port, instead of being in reverse phase with the cone frontal wave, is in phase and so reinforces the bass.

An impressive way of illustrating the effect of a bass reflex enclosure is to show the graph of a loudspeaker's impedance (see figure 5). Curve A is for the drive unit alone, and the impedance is seen to leap upwards at the resonant frequency and then rapidly die away. Curve B shows that the cabinet produces a much smaller double hump, with at least the promise of a smoother bass response. In passing, it will be seen that the 15-ohms nominal impedance of this particular unit applies only at around 400Hz, and is quite different elsewhere in the frequency band.

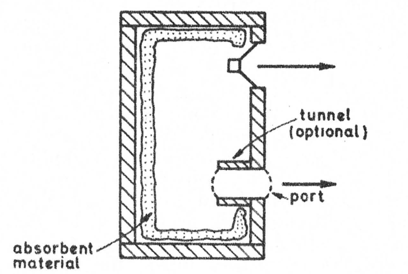


Figure 4: Bass reflex cabinet: the internal dimensions are tuned to the unit resonance and so in-phase radiation takes place from the port.

Other types of enclosure: Column loudspeakers had a spell of popularity when stereo first came on the scene but have now been largely superseded by the compact, infinite baffle units. The column has the distinct advantage that, while taking up only a limited amount of floor space—about 1 ft square—it can nevertheless have a decently large internal volume and the sound is radiated at a useful height to clear furniture, etc.

Instead of making the drive unit forward-facing at the top of the column, which might mean distortion due to strong reflections from the back and sides, it is usual to mount the unit on

its back. Then, to give a useful diffusion of high frequencies over the listening area, a conical reflector can be placed above the drive unit.

The column may be designed on any of the normal cabinet principles—infinite baffle, bass reflex—perhaps with a "distributed port" consisting of a number of holes or slots instead of a single opening—or two types not so far discussed, the folded horn and labyrinth.

Horn loading, that is the placing of a flared tunnel in front of a loudspeaker drive unit, gives a very worthwhile increase in overall efficiency. This leads to very low distortion, because the cone excursions can be so much smaller, and

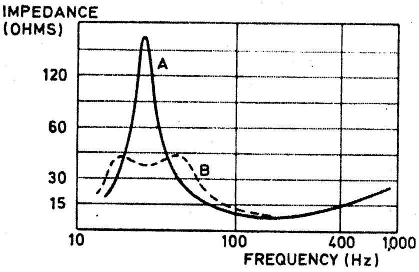


Figure 5: A properly tuned reflex enclosure changes the peak A in the unit's impedance curve to two smaller peaks B.

a clean, crisp response to transient sounds. Unfortunately, the sound output falls off rapidly below a critical frequency which depends on the size of he horn. Therefore, to cope with very ow frequencies, horns of 10 or 20ft ength are necessary with flare openings neasuring several square feet. Except for few amateur under-floor constructions, he only way that such dimensions can e accommodated is to fold the horn ack on itself at least once. The contruction of horn-loaded speakers therefore complicated and relatively ostly.

Much the same applies to labyrinth nclosures. Here the principle is that the ack radiation enters a very long, lagged ipe which absorbs it completely—only e forward radiation normally being sed.

Other types of drive unit: So far we ave dealt only with the moving coil pe of drive unit (figure 1). A number other types are in use, however, and serve brief mention.

First, the **ribbon loudspeaker:** this also s a powerful magnet but the coil/cone mbination is replaced by a single rrugated ribbon of aluminium. This is or 3in long by about ¼in wide and ts as coil and diaphragm simultaneous- Naturally the radiating surface is all and so, to increase the efficiency, bon speakers normally use horn load-. This applies, for instance, to the lly Ribbon tweeter which has a 9in rn and handles frequencies from about 00Hz upwards. A steep cut filter is essary to protect the ribbon from low quency currents but, on the credit e, the high frequency and transient formances can be excellent.

The **electrostatic loudspeaker** depends the force of attraction which exists ween electrically charged bodies. In simplest form, used in a number of h frequency designs, it consists of a tal plate over which is stretched a plastic film. The outer face of this film has a conductive coating and applying a voltage between plate and coating will cause an inward movement against the resilience of the film. If a DC bias of, say, 300 volts is applied, an alternating signal (not exceeding 300 volts peak) will produce the required vibrations. Special steps are necessary to overcome the distortions inherent in this simple arrangement, but the push-pull system obtained by having two fixed plates, with the diaphragm in between, virtually eliminates the distortion altogether.

The best known example of this latter system is the Quad Electrostatic loudspeaker. This covers the full frequency spectrum by using a central treble section operating from 200-300Hz upwards. On either side of this is a bass section having a greater plate spacing to permit the larger diaphragm displacements necessary at low frequencies. Special delay networks avoid too directional radiation at high frequencies, the result being a fairly even distribution over front and back angles of about 70 degrees. Since no cabinet is used, the Quad ESL avoids the problems associated with cabinet resonances, but against this must be weighted its greater dependence on room positioning and the fact that, though delayed, there must eventually be front/back cancellation effects at the extreme bass frequencies.

The **ionic loudspeaker** has no moving parts. A small volume of air in a quartz cell is subjected to a high voltage at a supersonic frequency. The effect is for the air to be ionised (formed into particles carrying positive or negative electric charges). If the high frequency voltage is modulated by the audio signal, the ionised air will tend to expand and contract and so generate sound waves. As with the ribbon speaker, the ionophone cell is situated at the throat of an expanding horn to give efficient radiation. This principle is used in the Fane Ionofane high frequency unit, operating at frequencies above about 3,500Hz.

Most of these special drive units are designed to handle only high frequencies and therefore must be used in conjunction with a conventional moving coil bass unit. The questions of multi-speaker systems, amplifier matching, room positioning, etc., will be covered in the next instalment.

Classical reviews

By JULIAN RUSSELL

Nielsen's 3rd Symphony—"finest work"

NIELSEN — Symphony No. 3 ("Sinfonia Espansiva"). Royal Danish Orchestra conducted by Leonard Bernstein. CBS Stereo SBR235210.

The music of Danish composer Carl Nielsen (1865-1931) had to wait till the early 1950s to win a brief few years of popularity in England. In Australia it still remains for the most part unknown and I can recall no more than a couple of performances of his symphonies at Sydney orchestral concerts. Those who wish to learn more about this unusual man can find everything set down lucidly and perceptively by Dr Robert Simpson in his biography, "Carl Nielsen, Symphonist" published in England by Dent.

Perhaps the most immediately noticeable characteristic of Neilsen's music is a constant struggle to reconcile a complex key scheme that employs constantly moving tonalities with orthodox sonata form, and it is this which gives his music its strong individual flavour. Another feature is the condensation of the material, often to the point of terseness. I am aware that these few words will give you little ideal of what the music sounds like. It is just as impossible to describe the sound of music works as it is to describe a scent.

For that reason the few-words I have written about Nielsen's music must suffice. But if you wish to hear an example of a work that is characteristically Nielsenian I can recommend this Third Symphony. It is considered by Danes to be his finest work, and Bernstein's performance of it in Copenhagen in 1965 was hailed by them as masterly. It was composed in 1911 when Nielsen was 46 and the sleeve notes make an interesting point when they list other works which were roughly contemporaneous—Stravinsky's "Petrouchska," Mahler's "Das Lied von der Erde" and Schoenberg's "Pierrot Lunaire," were three.

At a first run through, the work may sound to you quite simple. But one repetition should reveal just how complex it really is, and these complexities increase with familiarity with the score And appreciation is likely to grow with each repetition. But don't expect to be either shocked or bewitched. The music will remain healthily normal however well you come to know it — perhaps a little too normal for many contemporary tastes.

Bernstein is in one of his unbuttoned moods as he builds climax on climax and handles his o chestra in a manner that brings out all that is tuneful in the melodious score. And in the second movement Bernstein is deliciously lyrical in music that is essentially pastoral and features a wordless vocalise, sung by a soprano and baritone at a distance, that is given real perspective by the recording engineer. Bernstein caresses the music with true affection. And however much forceful vitality he displays elsewhere there is never a bar that might be properly labelled gauche.

★ ★ ★

NIELSEN— Symphony No. 6 ("Sinfonia Semplice"). Prelude to Act 2 of "Masquerade." Overture to "Masquerade." Philadelphia Orchestra conducted by Eugene Ormandy. CBS Stereo SBR235216.

If you are a stranger to Nielsen's music, and if what I have written above has kindled some curiosity to hear it, I recommend, as a starter, the Third Symphony, reviewed above rather than the Sixth, which, despite its title, is by no means simple. It is, in fact, enormously complex, even after several repetitions. Dr Simpson, Nielsen's biographer, thinks it inferior to the composer's other five symphonies and I am inclined to agree with him. But that is not to say that there are not some splendid pages (I know of nothing better in the Nielsen oeuvre than the first movement) side by side with some of decidedly lower quality.

In the latter class must be put the movement labelled "Humoresque" which has all the anticlimatic features of a joke that needs explaining. Not even the eloquent advocacy of Ormandy and his orchestra can make it gel. But elsewhere they are so persuasive, that you may finish up by liking it more than I do.

I cannot, however, imagine anyone being disappointed with the two fills, the enchantingly pastoral Prelude to Act 2 of "Masquerade" and the brilliant overture to the same work. The recording is good, though I did miss the golden quality of the Philadelphia strings; here they tend to harden in loud passages.

★ ★ ★

MAHLER—Das Lied von der Erde. James King (tenor); Dietrich Fischer-Dieskau (baritone). Vienna Philharmonic Orchestra conducted by Leonard Bernstein. Decca Stereo SET331.

Leonard Bernstein has been lavishly represented in recent recordings, and in none to greater advantage than in this outstanding Mahler performance. But I do not expect it to receive the unqualified acclamation of Mahler purists, and by these I mean the disciples of the Bruno Walter school of Mahlerian interpretation. This is not to be taken as disparagement of Walter's superb conducting of the works of a master whom he loved as much as he respected. His understanding of Mahler's aims was deep and wide ranging. But I think his readings much more likely to cloy than Bernstein's.

For Bernstein brings to "Das Lied von der Erde" a freshness and vitality that to me, gave new life to a work that I have perhaps heard too often in the past few years. And he achieves this in tw ways, tempos that at first might soun inordinately fast—the opening Drinkin Song is one example—and a degree o passion that stops only just this side o delirium. But stop it does, and I fin its emotional impact irresistible. An as if to contradict what I have jus written, Bernstein takes the final "Far well" movement slower than I have eve heard it played before. But he sti manages to keep the emotional messag unimpaired.

And even in his fastest passage Bernstein seems always to have enoug in hand to press on with even mo intensity during the many climaxes. Th extreme delicacy and clarity of Mahler scoring, despite the large orchestra h always used, has by now become legen ary, and Bernstein's ear is fully apprec ative of this aspect of the performanc as is the recording engineer, who h reproduced it so admirably. And th Vienna Philharmonic are at the top their form, a standard hard to beat even to match by any other orchestr

We come now to the vexed questi of baritone versus contralto in one of t vocal parts. Mahler himself approved t alternative, but the many who insist hearing a female voice claim that t baritone arrangement is only an expe ent. That is as it may be, but, if t voice is to be a male one, I can imag none better than Fischer-Dieskau's in eloquent part. He, too, is at the v peak of his form, if one excepts a t dency to slightly overdo emphasis in fourth movement.

The tenor part, with its high te tura, is immensely difficult to deli satisfactorily throughout, but Ja King's virile and expressive account the part leaves little to be desired o one has dismissed a tendency to st on the very highest notes. In my rev of this performance for the Sydney "S I went out on a limb by forecast so early in the year, that this would one of 1967's best productions. I h played it several times since then see no reason to change my opini

DEBUSSY—Rhapsody for Saxophone and Orchestra. Sigurd Rascher (saxophone). Rhapsody No. 1 for Clarinet and Orchestra. Stanley Drucker (clarinet).

HONEGGER—Rugby; Pastorale d'Ete; Pacific 231. New York Philharmonic Orchestra conducted by Leonard Bernstein. CBS stereo SBR235206.

Still another Bernstein recording, and if it isn't quite in the same class as the two previously noticed in this column, it is nevertheless highly enjoyable. Debussy fiddled around with the Saxophone Rhapsody for years. It was a commissioned work for an instrument which he disliked intensely. On its reluctant completion he lacked enough interest in it to orchestrate it, a task he handed over to his fellow-composer Roger-Ducasse.

However, since the Rhapsody is one of the very few serious works written for the saxophone it retains its place in current repertoires, and has been played by Sigurd Rascher for at least a generation. I remember hearing him play it in the Sydney Town Hall before World War II. But however often he may have played it since, he still makes it sound nice and fresh, and his technique is, of course, impeccable.

The Clarinet Rhapsody, on the other hand, was a work of which Debussy himself was extremely fond. It is in every way a better composition than the other. Its melodies are shapely and original, its harmonies subtle, its scoring deliciously fragile. Stanley Drucker, using a beguilingly reedy tone, overcomes its many formidable technical difficulties with almost ridiculous ease and Bernstein's orchestra provides an exemplary accompaniment.

Two of the three Honegger pieces sound very trite and contrived nowadays, however daring they might have seemed back in the early 1920s when the composer was a member of the then way-out French group known as "Les Six." "Rugby" is utterly poverty stricken in its thematic material despite the composer's efforts to disguise the fact by abrasive harmonies and coarse orchestration. And "Pacific 231"—the title is taken from the serial number of an American locomotive—sounds just as much like a train as ever, despite the composer's denial that it is onomatopaeic program music. But that is all.

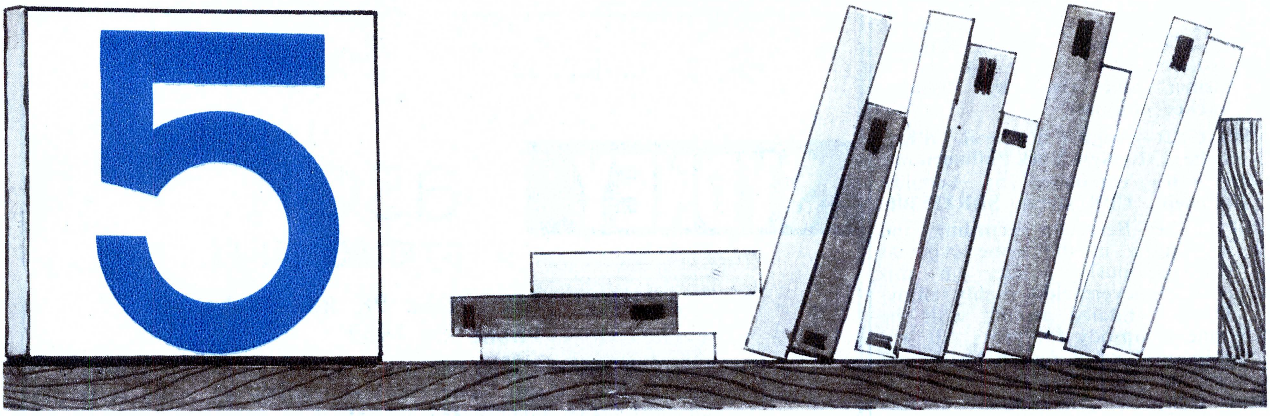
The only piece to wear well is the "Pastoral d'Ete," which, as the title suggests, is pleasingly pastoral, and responsively treated as such by Bernstein. The sound throughout is good.

* * *

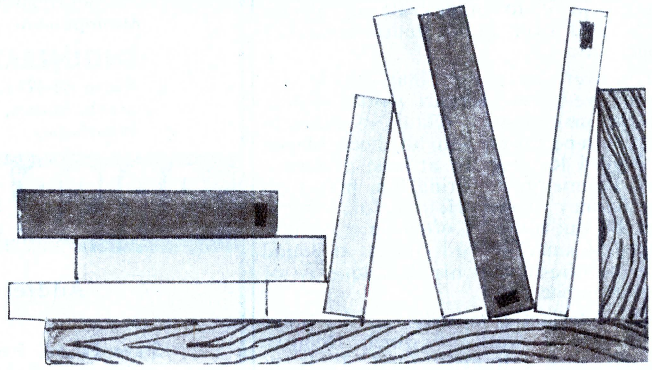
MOZART—Piano Concerto No. 8 in C Major (K.246). Piano Concerto No. 9 in E Flat Major (K.271). Rondo in A Major (K.386). Vladimir Ashkenazy (piano) and the London Symphony Orchestra conducted by Istvan Kertesz. Decca Stereo SXL-6259.

As Ashkenazy's list of recordings rows, so does his stature as a pianist. have not heard him play in public but n the strength of his recordings he is 'ell on the way to becoming one of the 'orld's finest. This month he makes his rst appearance in Mozart and, as you 'ill discover later in this column, Schuert. In both he is impressive—and imensely enjoyable.

Less than a year separated the comosition of these two concertos, but



REASONS WHY . . .



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Mozart took a vast stride in the direction of maturity in the second of them. The C Major calls for little more than a performance that can alternate effervescence with tenderness, both of which Ashkenazy awards it in generous measure. Yet he manages to fill his reading with a subtlety of phrasing and richness in tonal variety that makes one hope this disc will only be first of a series of Mozart concerto recordings. He is careful to keep his dynamic range well within permissible 18th Century limits without, however, producing the effect of a deliberate curtailment.

But the C Major, despite the surprises Mozart has in store for those who expect a conventional formal development and the superb polish of Ashkenazy's performance, is only small stuff compared to the E Flat, which is generally recognised as the first of the "great" Mozart piano concertos. This calls for much deeper emotional involvement on the part of the performers and a much greater variety of colour from the soloist. And again both are generously awarded, though, at the risk of appearing ungenerous myself in assessing the value of a performance that gave me so much pleasure, I must point out that in a couple of sequences a fraction more intensity would have been welcome.

The orchestra's contribution under Kertesz is in every way admirable, give or take an occasionally heavy string passage, and the engineering splendid. And for a fill, the A Major Rondo offers a small but welcome bonus.

★ ★ ★

MOZART — String Quartet in D Major (K.575) "Prussian" No. 1 String Quartet in F Major (K.590) "Prussian" No. 3. Weller String Quartet. Decca Stereo SXL6258.

This recording of two of the "Prussian" quartets will be welcomed by all Mozart lovers since I can trace no previous coupling in any catalogue of two of the set. Moreover they are seldom heard in the concert hall. (Since writing this I have learned that a version was put out by Vox, played by the Barchet Quartet some years ago and has long been deleted from local catalogues.) The Weller is a Viennese quartet whose members take their Mozart as they take life —urbanely, sensitive to nuance, and without apparent effort. The result is a performance that will, I predict, remain unchallenged in excellence for many years.

To those who insist on sharper accenting and a slightly less mellifluous style I put the question: "Where are they likely to hear playing that breathes more naturally and to which the listener can surrender himself with more sense of security?" The performers give the impression of playing entirely for their own enjoyment, and the listener feels privileged to be in on the treat. The tempos are sensible, and if the minuet in the F Major sounds a little more suave than it might in other hands, bear in mind that it was the precursor of the Viennese waltz.

There is, too, a tendency to linger over the delights of the Andante in the D Major, but since the slow movement of the F Major is an allegretto you don't run into the same problem there. The sound is generally speaking good without being outstanding and I could have put up with a little more weight in the cello part. No matter how I juggled my equipment I couldn't bring this out without destroying the balance elsewhere. But these are only minor shortcomings in a disc that is otherwise made for relaxed listening.

★ ★ ★

MOZART — Church Sonatas for Organ and Orchestra, Nos. 1-17. Marie-Claire Alain (organ) and the Jean-Francois Paillard Chamber Orchestra conducted by J. F. Paillard Andante in F Major for Organ. Fantasia No. 1 in F Minor for Organ (K.594). Fantasia No. 2 in F Minor for Organ (K.608). Marie-Claire Alain. World Record Club Stereos T4147/8.

I consider these much better performances than those by E. Power Biggs that I reviewed about nine months ago. Importantly Marie-Claire Alain's organ part is much less intrusive than Biggs. Indeed Madame (or Monsieur — the name is no clue?) Alain's playing is, for the most part, exactly what Mozart had in mind, for it must be remembered that these pieces were written for performance as short instrumental interludes during the Mass and in many of them the organ was called on to do no more than supply harmonies from a figured bass.

That this is not primarily organ music is made clear by the balance and the soloist's choice of a sweet, light-toned baroque instrument for her performances. These are by no means even. In some she is satisfied with a very matter-of-fact reading. Others — especially K.224 in F — are full of grace and charm. Taking them all round they may not be the best that might become available from time to time, but until something better turns up they will do very nicely.

The organ solos are also well played and though I have heard the Allegro in the K.594 sound a little sprightlier, the introductory adagio is fine. Similarly the K.608 starts impressively with a fine broad tempo but the next section grows a trifle confused in some bars. Throughout, the choice of stops provides plenty of variations in the sonorities and the sound is consistently first rate. Excellent value at the club price.

★ ★ ★

MOZART — Complete Dances and Marches Vols. 6 and 7. Vienna Mozart Ensemble conducted by Willi Boskovsky. Decca Stereo SXLA6199 and SXLA6246 (two discs).

There seems to be no end to these usually charming little pieces, most of them written as part of daily work for a patron. They were used as dances for a dance-mad population and as occasional pieces, dashed off at a moment's notice. But such was the nature of Mozart's genius that you seldom find one, however trivial, without some testimony to the inexhaustible ingenuity of its creator. The standard of performance is again irreproachable and the engineering tip-top.

★ ★ ★

BARTOK—Concerto No. 2 (1938) for Violin and Orchestra. Yehudi Menuhin (violin) and the New Philharmonia Orchestra conducted by Antal Dorati. Six Duos for Two Violins. Yehudi Menuhin and Nell Gotkovsky. HMV Stereo OASD-2281.

If I remember rightly, Menuhin was the first to record this Bartok concerto on 78s, back in the early days of the

war. My pressing has long since gone the way of all 78s so that I cannot compare that one with this, which was recorded late last year. Menuhin and the orchestra are both in fine fettle and handle the work's many intricacies with almost contemptuous ease. There is, however, no objectionable top-dressing of dash either in the solo or orchestral part. Indeed Menuhin seems intent on keeping his tone within strictly musical bounds when a slightly more forceful treatment seems to have been in the composer's mind.

Yet it cannot be said that the reading lacks fire. It glows most persuasively, even if it seldom bursts into flames. And I, for one, prefer this disciplined intensity to a more unrestrained exhibition of emotion. As to the engineering, some may find the solo part recorded a little too distantly for their taste, but in a work where the orchestral part has so much significance, I think this a fault on the right side. Moreover it gies one a chance to hear the quite marvellous score played with a perfection seldom met in a concert hall performance.

The deliberate hardening of tone some violinists use in the concerto, but which Menuhin deliberately eschews here, can be enjoyed in his playing of the Six Duos for Two Violins. This however, may be due, not so much to the difference in Menuhin's playing, but to the fact that in these he is recorded closer to the mike. At any rate if you find his version of the concerto over-refined, these admirable, and exciting, duos will supply just the right contrast. In these the sound has much more presence than in the concerto. And his partner, Nell Gotkovsky, contributes nobly to the success of the enterprise.

* * *

SCHUBERT—Piano Sonata in A Major (D.664). Piano Sonata in A Minor (D.784). Hungarian Melody (D.817). 12 Waltzes (D.145). Vladimir Ashkenazy. Decca Stereo SXL6260.

This A Major Sonata has acquired the nickname of the "little one." Dimensionally it may be smaller than most works of this kind. And the fact that it is sweetly tuneful—and often given to learners to practise — may encourage some to think that, interpretatively, it is child's play. Nothing could be more untrue. If you happen to be a pianist yourself, try it, then listen to how it sounds played by Ashkenazy. I should be surprised if the maturity of his interpretation doesn't quickly make you change your mind.

This is the only disc that couples the two major works you hear Ashkenazy play here and it is unlikely that a better will be put out in the foreseeable future. His reading of both works is warm, virile, and always aware of the many opportunities Schubert provides for a discriminating exponent to contrast the varying sonorities of the instrument. And the proportions of both works will deter even the most churlish critics of Schubert's prolixity from making their usual charges.

Nor are the fills without their own particular interest. The Hungarian Melody is unlikely to be familiar to anyone but a Schubert scholar. It was published for the first time as recently as 1928. And the tiny waltzes are full of graceful ideas, modestly but resourcefully treated. For Schubert-lovers, a must. For others—well, you'll certainly not find anything to complain about in the playing—or recording.

DOCUMENTARY RECORDS

Reviewed by Glen Menzies

"JULIUS CAESAR" Dramatic Highlights from the Sound Track of the M-G-M film. James Mason. John Gielgud, Marlon Brando, Louis Calhern and Company. Encore mono MGM-VO2 9307.

Back in the early 1950s, M-G-M made a movie of epic proportions of one of the timeless, and at the same time, most controversial of Shakespeare's plays. John Houseman, who produced the film, also selected the material which makes up this album; he also serves as the excellent narrator who fills in the story where necessary. n a personal note on the film he says, . . "we had one dominant artistic aim; to bring to a contemporary audience, in all their energy and beauty, he sustained dramatic impact of Shakespeare's words." In this respect, John Gielgud more than succeeds and James Mason and Marlon Brando acquit themselves very well indeed, but Louis Calern with his slightly twanging American accent fails to make much of Caesar (in words alone that is); perhaps is was a more dominating presence on ne screen.

This is, of necessity, a much truncated version of the complete Julius aesar; nevertheless, there is sufficient ft for us to grasp the broad outlines, be able to see Brutus as the central gure and the tragic hero, influenced Cassius, who as his associate and iend, helps to sow the seeds of doubt hich lead to Caesar's assassination. hn Gielgud gives a truly remarkable rformance as Cassius. In a wonderlly vibrant, perfectly poised piece of ting, his articulation is phenomenal d each word is precisely focused in ch a way that it helps to build tension a cumulative, rather than immediately notional way.

Though a little overshadowed by Giel-d, James Mason misses few opporities in his role as the young idealist, o, instead of benefiting his country, nges it into ruin and civil war. In verbal exchanges between these two side one, as Cassius uses all his vers of persuasion to finally convince itus, we can only marvel at Shakeare's genius for dialogue.

Brando is something of a surprise. voice is better than I was prepared expect, remembering some of his vies of a few years ago, in which he ned forever condemned to be inartiite. He is no Shakespearean actor as we might find at Stratford-onn, but nevertheless he makes a hful sounding Mark Antony, a little se at times but still able to raise multitude to a frenzy of revenge. is it that the sound of an angry always sounds even more ominous film sound track? Irrespective of our familiarity with the "Friends, ians and Countrymen, Lend me your " soliloquy, this is a great piece of natic writing which also reveals k Antony as a quite remarkable ical opportunist.

ven in this drastically shortened form I have found this album a stimulating experience with much to think about with regard to the rights and wrongs of Caesar's death and the fate of the republic over which he ruled. This is a generous disc which runs for just over the hour, and apart from a little hardness in places, the sound is clear and the dramatic impact considerable. With the exception of some "typical" film music at the start, Miklos Roszas score is subdued. The chosen excerpts dovetail together very well with the help of Mr Houseman's linking narrative. As a primer, for a closer look at a great Shakespearean play, this Encore reissue can be wholeheartedly recommended.

* * *

TALES OF EARLY AUSTRALIA: Read by Wilfrid Thomas. Festival, Mono FL-32,138.

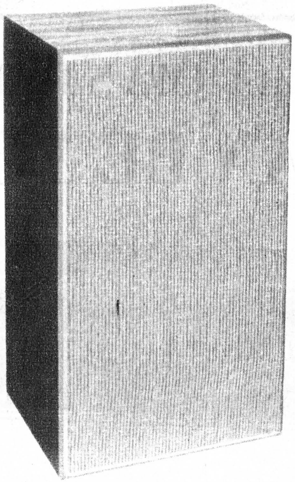
This album makes an interesting follow up to my review last month of the poems of Banjo Paterson and Henry Lawson, but this time the material comes from many sources with quite a few anonymous Australian poets represented. Wilfrid Thomas remains one of the best known of Australian broadcasters despite the fact that he has resided in London for many years. Familiarity with the reader's very singular voice made me wonder whether the recital would capture and hold my attention right throughout both sides. I can say after several hearings that it makes an outstanding addition to the spoken word field, and Mr Thomas emerges with flying colours.

He takes an unorthodox view of the poems, looking first for the hard core of the narrative to give the impression of a story-teller at work, rather than just a mere reciter. This is not to say that he is insensitive to the rhymes and rhythms themselves, but he knows just when to throw away a word whilst keeping the story line flowing freely. His use of light and shade is excellent and the changes of pace are extremely well-judged.

Much of the material has been culled from the two volumes, "Australian Bush Ballads" and "Old Bush Songs," compiled by Douglas Stewart and Nancy Keesing, and are well contrasted, some humorous, some dramatic, some protesting and others touched with sadness or tragedy. "The Convict in Chains," "Female Transport" and "10,000 Miles Away" are all concerned with horrors of being transported to Van Diemen's Land. But "Dick Briggs From Australia" is from the opposite view altogether — a well brought up Englishman returns back home to England and to polite society after a spell in the Australian Outback, his language having undergone radical changes. This is read in a racy fashion with sharp awareness of the peculiarities of the Australian idiom. There are a number of Bushranger poems including one by Edward Harrington which dwells not so much on Ned Kelly the folk hero, but the tragedy of his death; in contrast, an anonymous poem simply called "The Kellys," emphasises his dashing heroism.

It was an interesting excercise to be able to play Banjo Paterson's, "The Travelling Post Office," which I noted in last month's review of "The Best of Banjo" read by John Clements. There is a quite different approach in the readings, with Wilfrid Thomas emerging as the more unorthodox reader who places greater emphasis on the poem's inner contrasts and changes of pace.

The recording is technically very good, it is so clear in fact that any fault in Wilfrid Thomas's microphone technique would have been glaringly revealed. For those with wide range equipment, I recommend the use of a top cut filter to reduce the tendency towards a slight hardening of tone at this end of the range.



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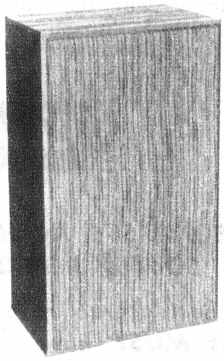

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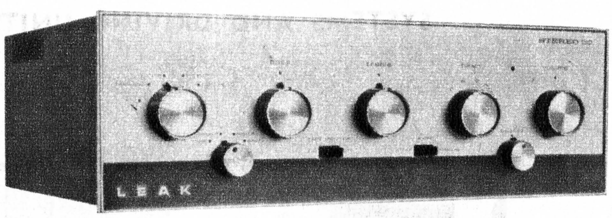

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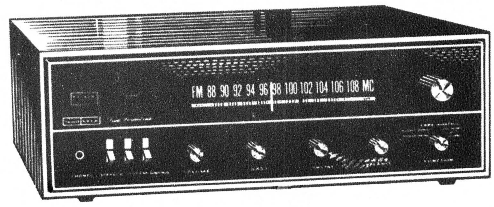

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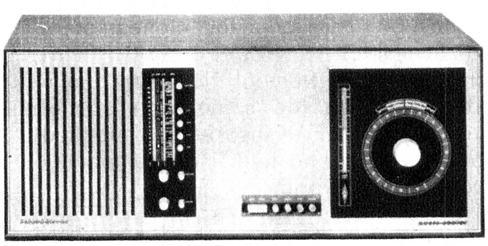

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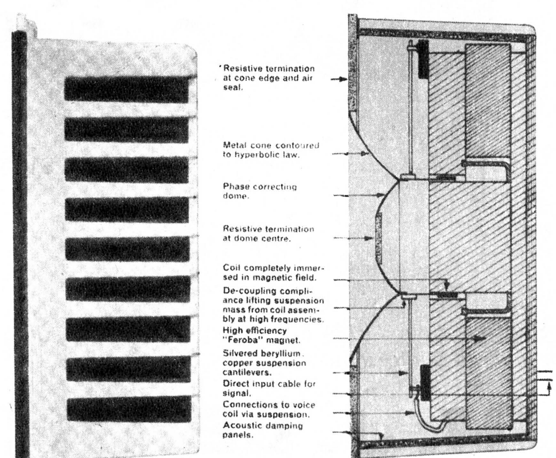

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VARIETY FARE

★ "ELECTRONICS Australia" Staff Review Panel

Devotional

STORIES WITH A MESSAGE. Rev Roger Bush. Mono, ATA (Festival) ATAL-32,259.

Interest: Stories for children.
Performance: Sincere.
Quality: Well recorded.

Roger Bush, one-time member of the R.A.A.F., university student, public servant and industrial worker, is now the Rev. Roger Bush, minister of the Crows Nest Methodist church, on Sydney's north side. He also broadcasts regularly over the ABC and conducts a "Helping Hand Mission" column in the Sydney "Sunday Mirror."

On side 1 of this album, he recounts the story of the Passion, Crucifixtion and Resurrection, in terms which closely parallel the Bible account. The telling could be shared by all ages, particularly at the Easter season.

The remainder of the album is devoted to seven stories for children, in the manner of legends or fairy tales, but each with a scriptural moral — hence the title.

The narration is straightforward and sincere and I imagine that, in a sympathetic home situation, the children could well come to regard this as "their record." (W.N.W.)

★ ★ ★

ROOM AT THE CROSS. Al Garr, Tenor, with Paul Mickelson Orchestra and Choir. Stereo, Supreme SS-2001. Also available in mono SM1001. (Supreme Productions S.E. Asia Ltd.).

Interest: Gifted Gospel tenor.
Performance: Very smooth.
Quality: Good.
Stereo: Modest.

Al Garr, son of an itinerant evangelist, showed an early preference for show biz. over his father's calling to such good effect that he later starred as a tenor soloist for three years on a CBS coast-to-coast radio show and was associated with John Nesbitt on his famous "Passing Parade" series. But, on the eve of bigger things, he cancelled his radio and film contracts and took up theological studies; these were interrupted by war service, which took him through the Normandy landing as a Lieut. Colonel.

Since then, he has become deeply involved in various aspects of evangelism but with a continuing interest in singing. His sense of pitch, smooth production and excellent diction are all evidence of thorough training and the only reservation one might have would be in terms of a general preference for other than a tenor voice.

In a well varied program, the track titles are: Count Your Blessings—Blessed Be The Glorious Things—Moment By Moment—Someday, Sometime—The Lord Is My Shepherd—Ye People Rend Your Hearts and If All Your Hearts (from "Elijah")—I Won't Have To Cross Jordan Alone—The Hem Of His Garment—When I Found Jesus—I Have Found A Hiding Place—Onward With Christ—Room At The Cross.

With orchestra, choir, piano and organ providing varied accompaniment under the hand of Paul Mickelson, this is a pleasant, sincere and well-produced album. (W.N.W.)

★ ★ ★

MORE SOUTHLAND FAVOURITES. George Beverly Shea. Arranged by Anita Kerr; produced by David Rice. Stereo, RCA LSP-3634. Also in mono LPM-3634.

Interest: Best known Gospel soloist.
Performance: Typical.
Quality: Good.
Stereo: Used effectively.

Those charged with the responsibility of meeting the seemingly insatiable demand for Bev. Shea recordings must be as hard put to it to think up new presentation ideas, as this reviewer is to think up something different to say about them. The theme here is "Southland favourites" and the jacket notes which, for other artists, would have been emphasising the Anita Kerr Singers and the Nashville sound, are content to refer to "the gentle rhythm so characteristic of the Bible Belt."

The "gentle rhythm" and Anita Kerr's arrangements are evident almost exclusively in the instrumental and vocal accompaniment. Bev. Shea sings on in much the same fashion as in any one of his other albums. The track titles: Kneel At The Cross—The Wonder Of It All—Adoration — The Stranger Of Galilee—I Shall Not Be Moved—Beautiful Isle—Ten Thousand Angels — The Night Watch — Sometime — God Is Still On The Throne — Oh Gentle Shepherd—Jesus Will Give You Rest.

For those with a place in their collection for yet another Bev. Shea album, this one features a modest up-tempo treatment. Quality and stereo are well up to standard. (W.N.W.).

★ ★ ★

ELLA FITZGERALD'S BRIGHTEN THE CORNER. With the Ralph Carmichael Choir and Orchestra. Stereo, Capitol ST-2685. Also in mono T-2685.

Interest: Ella's first Gospel album.
Performance: Appealing.
Quality: Excellent.
Stereo: Modest but effective.

Only those with a rigid dislike for Negro style Gospel should fail to enjoy this, the first devotional album by that most accomplished singer, Ella Fitzgerald. The elements of the Negro style are all there but in moderation — the vocal improvisation, the emotional intensity and, in other numbers, the joyous rhythm. And what excellent support is given by the Ralph Carmichael Choir and Orchestra. They're on the job all the time and while, frequently, one is aware of their deft touches, they never exceed their basic task of complementing the soloist.

In a generous and well varied program, occupying more than 40 minutes, Ella sings no less than 14 well known hymns: Abide With Me—Just A Closer Walk—The Old Rugged Cross—Brighten The Corner—I Need Thee Every Hour—In The Garden—God Be With You Till We Meet Again—God Will Take Care Of You—Throw Out The Lifeline—I Shall Not Be Moved—Let The Lower Lights Be Burning—What A Friend We Have In Jesus—Rock Of Ages, Cleft For Me.

While I have sometimes voiced reservation about Gospel songs — presented Negro style or by singers with a purely "entertainment" background—this album I thoroughly enjoyed. Well worth a hearing. (W.N.W.).

Instrumental, Vocal & Humour

IOLANTHE by Gilbert and Sullivan. World Record Club, two record set, stereo. Available in mono.

Interest: Gilbert and Sullivan.
Performance: First class.
Quality: Excellent.
Stereo: Good spread.

"Iolanthe" was the first work to be presented at the Savoy Theatre built by Mr D'Oyly Carte especially for the purpose of presenting Gilbert and Sullivan operas. It may thus be regarded as the first of the Savoy operas, although the earlier operas can justifiably be included in the Savoy category through subsequent performances there. Many G. and S. devotees regard the music as Sullivan's finest score, including no less an authority than Thomas Dunhill (Sullivan's most vociferous champion). Moreover, the satire, with its sly digs at the anachronostic House of Lords, wears very well. The present day popularity of the work is therefore not surprising.

The cast here is mostly the same as that featured in the other World Record Club presentations of G. and S., with veteran "Savoyard" George Baker playing the demanding part of the Lord Chancellor—surely the most difficult in all the Savoy operas. Those fine singers Elsie Morison and John Cameron take the parts of Phyllis and Strephon, while Marjorie Thomas is in the title role of Iolanthe. The other performers are: Monica Sinclair as Queen of the Fairies; Ian Wallace as Earl of Mountararat; Alexander Young as Earl Tolloller; Owen Brannigan as Private Willis; April Cantelo and Heather Harper as fairies. The Pro Arte Orchestra and Glyndebourne Festival Chorus are conducted by Sir Malcolm Sargent (who also has a reputation as a champion of Sullivan's music.)

As one would expect, this distinguished cast present an eminently satisfactory performance of this tuneful score. The excellent quality sound and low surface noise allow one to follow the plot without the aid of a libretto, although here and there sections are recorded at rather low level, so that one has to strain the ears a little. (H.A.T.)

★ ★ ★

BLOOD AND SAND. Music from the film composed and performed by Vicente Gomez, with Graciela Parraga (vocalist) and supporting instrumentalists. Universal Record Club stereo U-753. Available in mono.

Interest: Spanish style film music.
Performance: Exciting.
Quality: Excellent.
Stereo: Normal.

The music written by Vicente Gomez for the Hollywood epic "Blood And Sand" is unusual in that it gains considerably in stature out of its film context. I saw the film on two occasions, and was impressed by the music both times, but I did not realise how good it is until I had the opportunity to hear it away from the visual distractions of the cinema.

The sleeve note refers to Senor Gomez as "performer, composer, musician extraordinary." I would not quarrel with this description, since his skill as a composer and performer are amply demonstrated here. However, I thought the outstanding talent on this disc is exhibited by Graciela Parraga, singing most expressively and with great versatility. She is at her best in the beautiful ballad "Verde Luna," singing with a voice as dark and warm as black velvet but, when the livelier tempos demand it, with a hint of mischievous laughter, or flamenco fire. She appears in six of the eight tracks and is impressive in every one.

The eight tracks are entitled: Blood And Sand — Torero Serenade — The Price of Glory — Fiesta Torera — Chi Qui Qui — Green Moon (Verde Luna) — Love And Sorrow — Cafe Pirate. All these have vocal except "The Price Of Glory" which is an arrangement of "Verde Luna" for guitars and flute; and "Love And Sorrow" which is a grave little tiento for solo guitars. I recommend this disc to those who have a liking for Spanish music with a little more freedom than the purely flamenco style. (H.A.T.)

★ ★ ★

BROADWAY STEREO SPECTACULAR. Nobuo Hara and his Sharps and Flats, with the SDS Choir. Stereo, Universal Record Club SU-833.

Interest: Broadway favourites.
Performance: Tuneful.
Quality: Excellent.
Stereo: Likewise excellent.

I tend to be a trifle wary about "spectaculars." As often as not, the term provides the excuse—or the explanation—for a noisy display by musicians and stereo technicians alike, and which I personally find rather wearing after a few tracks. However, this album, from an original recording by King Records, Japan, is not lacking in variety, but it does retain the mood of the original scores and it is pleasantly listenable. A novel feature is the complete replacement of strings by a vocal chorus, yet without one spoken syllable. The numbers are surefire favourites:

Maria — Tonight — Hernando's Hideaway—Bali Ha'i—C'est Magnifique — If I Loved You—On The Street Where You Live—Get Me To The Church On Time—I Could Have Danced All Night —Oh, What A Beautiful Morning — They Say It Is Wonderful—Hello, Young Lovers.

A good one. (W.N.W.)

★ ★ ★

CINEMA. The Knightsbridge Strings. Monument (Festival) stereo S(PL)-932,182. Available in mono.

Interest: Film favourites.
Performance: Lush.
Quality: Good.
Stereo: Good spread.

Film tunes which have remained firm favourites long after the screen epics themselves disappeared from the scene are featured in the ten tracks presented here. Those who have already heard The Knightsbridge Strings will know what to expect—lush arrangements with the emphasis on the melodies right through. Every member of the orchestra puts his art at the service of the melody, with individual virtuosity rigidly excluded, so that one is carried along by the tune without being particularly aware of the vehicle. Incidentally, don't let the name


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fool you—this is not just a string orchestra, but a comprehensive ensemble with woodwinds, brass and percussion sections. It does, however, have an unusually large string section which gives the characteristic lush sound.

Tune titles are: Temptation — My Melancholy Baby—As Time Goes By—Moonlight Becomes You—You'll Never Know — You Made Me Love You — Tangerine—Over The Rainbow—Laura —That Old Feeling. Sound quality and stereo separation are up to standard. (H.A.T.)

★ ★ ★

HANDEL: Concertos for Lute and Harp, Op. 4, No. 5 in F major and No. 6 in B-flat major. Desmond Dupre, lute, and Osian Ellis, harp. Concerto Grosso in C major ("Alexander's Feast"), the Philomusica of London conducted by Granville Jones; organ and harpsichord continuo by Thurston Dart. World Record Club 12in stereo, S/T4219.

Interest: Handelian concerti.
Performance: Fresh, lively.
Recording: Excellent.
Stereo: Widespread.

A little gem for Handel lovers, this one. Originally from the catalogue of L'Oiseau-Lyre, it features the "Alexander's Feast" Concerto Grosso together with Thurston Dart's reconstruction of the supposed original form of the fifth and sixth opus 4 concerti. It may be remembered that these are usually regarded and played as part of the remaining opus 4 organ concerti, although there is strong evidence that neither were composed for organ.

It makes delightful listening, indeed. As chamber works with the solo parts featured on lute and harp, the two opus 4 concerti really sound fresh and lively as compared with most organ performances. The balance which has been set between soloists and continuo is quite superb, and could hardly be bettered. The same high standard is maintained in the concerto grosso, too—what a pity this lovely little work is usually omitted from performances of "Alexander's Feast"!

The technical side of the recording is quite the equal of the performance. There is negligible noise and distortion, and the stereo is widely spread yet quite smooth. For lovers of Handel, then, a disc that can be warmly commended. (J.R.)

★ ★ ★

AN ORCHESTRA OF ORGANS. Buddy Bonds. Stereo, 20th Century Fox STL-932,156. Also in Mono TL-32,156.

Interest: Three organs.
Performance: Good.
Quality: Good.
Stereo: Normal.

Buddy Bonds, well known in the U.S. club circuit as a duo-organist, comes to light here with an organ trio—plus: Buddy Bonds, Baldwin organ; Ray Jenkins, Hammond organ; Darrell Stuckey, Wurlitzer organ; Bobby Haggart, bass; Sol Gubin, drums.

On stage, I imagine the group could be quite a hit but, without the visual, the involvement of the five players, three organs, bass and drums is largely lost. One is liable to feel that, in terms of sound, Reginald Dixon and his Blackpool Wurlitzer could do at least as well on his own. Mind you, he doesn't carry his instrument round from club to club!

Still, if electronic organ sounds intrigue and you want to try your hand at picking them, listen to side 2, which has a lot more get-up-and-go than side 1. The titles: Have You Heard The One About — I Want to be Happy — Little Girl Blue — How About You — Don't Take Your Love From Me — Let's Fall In Love — Teenage Polka — Anema E Core — This Can't Be Love — I Wish You Love — The Boy Next Door — Olay. (W.N.W.)

★ ★ ★

ITS A GUITAR WORLD. Chet Atkins. RCA Dynagroove stereo LSP-3728. Available in mono.

Interest: Popular guitarist.
Performance: First class.
Quality: Excellent.
Stereo: Good.

If you like the Nashville style of guitar playing, you are hardly likely to hear a more skilful exponent than Chet Atkins. In fact, I would go so far as to say that I have never heard better such playing than is to be found on this disc. Chet Atkins turns out a splendid performance with some first class support from some of the competent (but un-named) Nashville musicians, playing the following: What's I Say — Cast Your Fate to the Wind — Lara's Theme — A Taste of Honey — For No One — Pickin' Nashville — January in Bombay — Ranjana — What Now My

Band and its traditions

SOLDIERS. The Band Of The Grenadier Guards conducted by Captain Rodney Bashford. Stereo, Decca SKLA-4750. Also in mono LKA-4750.

Interest: Sound documentary.
Performance: Very good.
Quality: First rate.
Stereo: Outstanding.

This record reminded me very strongly of that other very early and very successful Decca release "A Journey Into Stereo Sound." It has the same careful planning, the same ring of authenticity and the same technical finesse.

As the title would suggest, it is a sound picture of a soldier's life. Beginning with Reveille, and a training sequence, it highlights the ceremonial with a representation of the changing of the guard. Commands echo from here and from there; marching feet cross the parade ground in front of the stereo microphones and, punctuating it all are marching tunes from the Band Of The Grenadier Guards.

On side 2 is a sound montage of war —first a war of foot soldiers, cavalry and old-world muskets and cannon. Then the scene changes to pom-poms, ack-ack, aircraft and tanks. The music changes likewise from simulated seventeenth-century sound to a modern military band, marching by and then fading into the distance.

To those readers who wait for the rare, good band recording, here's one you should hear. What there is of the band is superb and, if it occupies the sound stage for only part of the total time, I imagine that anyone interested in band music will be interested also in the traditions which gave it birth.

Technically, the quality, definition and stereo separation are excellent. Recommended. (W.N.W.)

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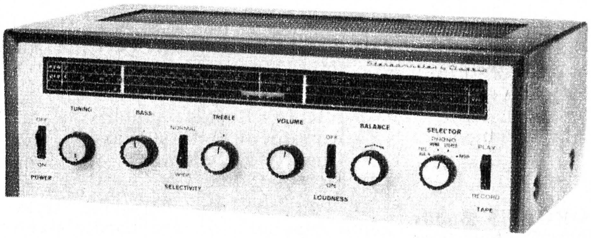

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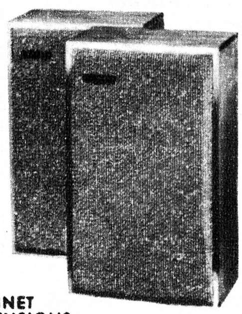

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As featured in "Mullard Outlook," April, 1966, issue.

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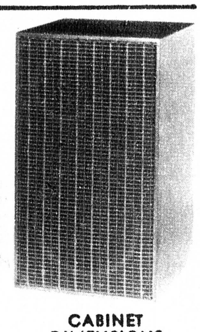

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Love — 'Na Voce, 'Na Chitarre 'E Poco 'E Luna — Star Time — Sempre.

In "January in Bombay" and "Ranjana," Chet joins forces with one of India's outstanding sitar players to play rather weird duets with the plangent quarter tones of the oriental instrument imitating the guitar, and the guitar doing its best to sound oriental. A welcome touch of variety with considerable interest. (H.A.T.)

★ ★ ★

BANDSTAND No. 10 G.U.S. (FOOTWEAR BAND) Conducted by Stanley H. Boddington L.R.A.M., A.C.R.M. Stereo, Columbia SCXO-6050. Also in mono 330SX-6050.

Interest: Small but proficient band.
Performance: Some good playing.
Quality: Clean but "dry."
Stereo: Pronounced separation.

This band is just about as different as it could be from The Band Of The Grenadier Guards, mentioned elsewhere. Whereas the Grenadier Guards gain a weight and a richness from the very size of the band, this, by contrast, is a much smaller group. The difference is emphasised by the very "dry" or non-reverberant environment in which this particular recording has been made. Significantly, the program was recorded while the band was on tour in Switzerland and exactly the same criticism has been levelled at other Swiss recordings which have reached Australia on another label.

The end result is that where the band tries for a big sound, as in "Anchors Aweigh," it just isn't forthcoming. The players work hard, especially the drummer, and that's exactly the way it sounds!

On the other hand, some very excellent instrumental work is revealed by the combination of a non-reverberant studio and highly perceptive stereo and those inclined to analyse performances and techniques within a band will find plenty to listen to. In fact, herein lies its major appeal.

The track titles: March Of The Swiss Alpine Club—Una Voce Poco Fa—Symphony Of Marches—Lisbon Carnival—Eternal Father, Strong To Save—Anchors Aweigh—The Lost Chord—The Shipbuilders—Slavonic Rhapsody No. 1—King Of Glory, King Of Peace. An album that will appeal strongly to some, very little to others. (W.N.W.)

★ ★ ★

MUSIC FOR WIVES AND LOVERS. Nelson Riddle and orchestra. United Artists (Festival). Stereo SUAL-932,296. Also available in mono, UAL-932,296.

Interest: The Nelson Riddle style.
Performance: Smooth.
Quality: Very good.
Stereo: Well exploited.

This record features a selection of movie themes and popular "show-tunes" some of which are identified with well-known vocalists, although the recording is strictly instrumental. The tracks are: Side 1: Cabinet—Born Free—What Now My Love?—Yesterday—The Shadow Of Your Smile—Somewhere My Love. Side 2: Winchester Cathedral — Wives And Lovers—A Man And A Woman—Spanish Eyes—Music To Watch Girls By—Strangers In The Night.

The arrangements are distinctly those of Nelson Riddle with his smooth up-tempo style. Very effective use is made of a jazz organ, played somewhat after the style of Jimmy Smith, together with the rather dominating sound of a harmon-mute trumpet. Despite the competition between the organ in one channel and muted trumpet in the other, the arrangements will set a swinging mood for many besides just "wives and lovers." (A.J.L.)

★ ★ ★

THE BEST ORIGINAL SOUND TRACKS And Great Themes From The Motion Pictures. United Artists (Festival) stereo SUAL-932,293. Also available mono UAL-932,393.

Interest: As per title.
Performance: Excellent.
Quality: Very good.

To the movie fan this record will have special appeal, as it contains a selection of themes and other instrumentals from the motion pictures, including "Dr Zhivago," "A Funny Thing Happened On The Way To The Forum" and "The Russians Are Coming." The tracks are; Side 1: Hawaii—Return Of The Seven—The Fortune Cookie—After The Fox—Duel At Diablo—Khartoum. Side 2: A Man And A Woman — Cast A Giant Shadow — Viva Maria — Somewhere My Love—Escorts Away—Comedy Tonight. (A.J.L.)

★ ★ ★

PERCUSSIVE MARIACHI, arranged and conducted by Ted Sommers. United Artists stereo SUAL-932,295. Available in mono.

Interest: Varied percussion.
Performance: Stimulating.
Quality: First class.
Stereo: Excellent.

The sleeve note lists no fewer than 38 percussive devices as being used in this recording, from the familiar drums, tympani, vibraphone and tambourine to the exotic Chinese bell tree, cold grass drums, and jawbone. With this astonishing range of instruments, Ted Sommers and his band of collaborators produce their versions of some of the familiar tunes one hears so frequently nowadays in Mariachi arrangements: Feelin' Good—The Apple Tree—Never on Sunday—If I Were A Rich Man—Watermelon Man—La Bamba—Samba de Orfeu—Carnival—Brasilia—Dark Eyes—Work Song—Tequila.

The amount of enjoyment you are likely to get from this disc will depend on your liking for percussion generally. Some folk, including myself, thought it rather overdone; others thought it quite perfect. It is definitely not music for relaxation—it is too stimulating for that. Probably the best thing to do if you are interested is to try to hear a few sample tracks at your record dealers—I suggest "Never on Sunday" and "If I Were a Rich Man" as two of the best on the disc. (H.A.T.)

★ ★ ★

THE DREAM PIANO. Aldo Ciccolini plays music of dreams and dreamers, Capitol (E.M.I.) stereo SP 8651. Available in mono.

Interest: Classical snippets for piano.
Performance: Tasteful.
Quality: Excellent.
Stereo: Not significant.

If the contents of this disc had anything in common with the tasteless cover design, depicting a piano adorned with flowers and cute little birds, with cherubs peering coyly from all angles, it would be a painful experience for any self-respecting music lover. Fortunately, Signor Ciccolini proves himself to be a musician of sensibility and refinement, so that he is able to overcome the difficulties inherent in a program consisting entirely of the easier type of light classic piece, to make them sound like the masterpieces in miniature they are.

Signor Ciccolini has a finely controlled touch and a fluid keyboard technique which even the most critical listener should find without blemish. If his dynamic range seems rather limited, this could be due to the prevailing restful mood of the pieces: Nocturne in E Flat Op. 9, No. 2 (Chopin) — Liebestraum No. 3 (Liszt) — Adagio from "Moonlight" Sonata (Beethoven)—Study In E major, Op. 10, No. 3 (Chopin) — Spring Song (Mendelssohn) — Fur Elise (Beethoven) — Prelude in C sharp minor (Rachmaninoff) — Clair de Lune (Debussy)—Idylle (Chabrier) — La Plus que Lente (Debussy)— To Spring (Grieg). These pieces are all so familiar that it is hardly necessary to enlarge on the above. However, those who cannot remember opus numbers may care to know that the Nocturne is the famous one which seems always to appear in recitals of this kind, and the study is the one known as "Tristesse." The Liebestraum is also the most famous of the set.

It is only necessary to add that the

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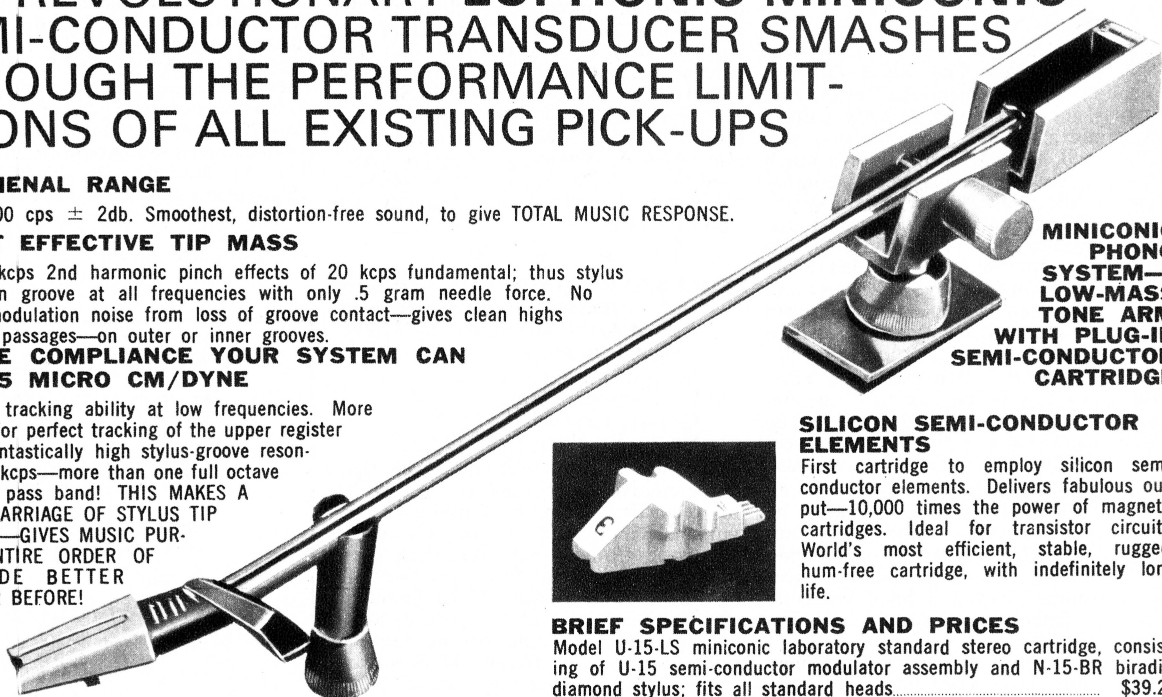

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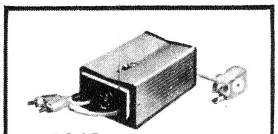
—thus saving the delicate record grooves. The U-15 cartridge is essentially a modulating device, not a reciprocal generator. Miniature-type P-15 power source (left) has all cables to plug into any high-fidelity amplifier. Includes switch to feed low-level magnetic inputs or high-level auxiliary inputs. Works from 240 volts A.C. supply. $37.60.



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Note: All the above cartridges require a power source.

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TEST REPORT BY HIRSCH-HOUCK LABORATORIES in "ELECTRONICS WORLD" July—1965

FREQUENCY RESPONSE RANGE: "The frequency response was unusually flat and peak-free over the entire audio range—we would confirm Euphonics' claim of ± 2db. response from 20 to 20,000 cps."

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RCA32X.FPM

sound quality is of excellent standard, and it will be obvious that this is a record which those with a taste for classical snippets can buy with confidence. The stereo does not add anything to the listening qualities. (H.A.T.)

★ ★ ★

LATIN AMERICAN HITS. Los Campaneros with the Frank Raye Singers, conducted by Sebastian Mure. Universal Record Club, stereo U741. Available on mono.

Interest: See title.
Performance: Typically slick.
Quality: Very good, but . . .
Stereo: Normal spread.

Recordings of Latin American music are so numerous that the potential buyer is posed a considerable problem. The choice at the moment seems to lie largely between the "bullring" sound now so much in vogue, the nightclub orchestra and the traditional vocal group with orchestral backing. It is to the latter category that this disc belongs, and I have no hesitation in giving it a high rating, as far as the contents and performance are concerned. The titles include some of the best-known Latin American tunes, mainly oldies which show no signs of diminishing in popularity as the years go by: Amor—Me Lo Dijo Adele—Mambo Jambo—Frenesi—No Puede Quererte — Adios — Besame Mucho — El Cumbanchero — Te Quiere Dijiste — Aquellos Ojos Verdes — Patricia — Solamente Una Vez.

The band and the Frank Raye Singers make the most of the catchy rhythms of the rhumba, samba, cha cha, etc., etc., and perform in the typically slick style of Latin American groups. They sing mainly in Spanish, although a few verses are repeated in English. Sound quality is good in the main, but deteriorates slightly toward the end of each side. The stereo is widely spread, but is rather weak in the middle, owing to the singers having been grouped at the sides (H.A.T).

★ ★ ★

CLASSICAL ARIAS. Maria Callas with the Paris Conservatoire Orchestra conducted by Nicola Rescigno. World Record Club stereo S/T 4218.

Interest: Soprano arias.
Performance: Could be better.
Quality: Very good.
Stereo: Normal.

Madame Callas does not often move into the realms of German opera, but here the whole recital is devoted to the works of Mozart, Beethoven and Weber. The single Beethoven work is his dramatic aria for soprano and orchestra, intended for concert performances — "Ah, Perfido." Weber also is represented by a single work, the popular aria "Ocean Thou Mighty Monster" from the opera "Oberon." The dramatic nature of these suits Madame Callas' declamatory style, and she sounds quite at home here.

It is a different story in the Mozart. Here she sings three arias from "Don Giovanni" — Oh! Crudele (Non Mi Dir), In Quali Eccessi (Mi Tradi Quell'alma Ingrata) and Or Sai Chi L'Onore — and the beautiful "Porgi Amor" from "The Marriage Of Figaro." While Madame Callas' style is undoubtedly well suited to the bel canto singing of Italian opera, her rather hard tone and wide vibrato sound quite unconvincing in these Mozart works, which require a higher degree of characterisation than she seems able to provide. In the "Porgi Amor" she just does not convey the image of a gentle, grieving woman, and in the "Non Mi Dir" she runs up against the intricacies of Mozart coloratura writing, with which she seems quite unable to cope — I can only describe her handling of this as inept (H.A.T.).

★ ★ ★

CELESTE AIDA. Richard Tucker. CBS stereo SBR 235218. Available in mono.

Interest: Opera favourites.
Performance: Excellent.
Quality: Excellent.
Stereo: Normal.

Although CBS could be buying an argument in suggesting that the world's favourite tenor arias all come from Italian and French operas (mainly the former) without so much as a glance at the German and Russian composers, few would quarrel with their choice of Richard Tucker to sing them. Considered by many to be the best operatic tenor singing today, he is always a pleasure to listen to. In addition to the more common attributes of the top-ranking opera star, he has the virtues of bright clear tone with none of the pain-laden inflections which so many tenors acquire; and his high notes are entirely unforced.

There are 14 tracks (excellent value for money) entitled: Celeste Aida from "Aida" (Verdi) — Che Gelida Manina from "La Boheme" (Puccini) — Recondita Armonia from "Tosca" (Puccini) — E Lucevan le Stelle from "Tosca" (Puccini) — Ah Si, Ben Mio from "Il Trovatore" (Verdi) — Di Quella Pira from "Il Trovatore" (Verdi) — Flower Song from "Carmen" (Bizet) — La Donna e Mobile from "Rigoletto" (Verdi) — Questa o Quella from "Rigoletto" (Verdi) — Ah Fuyez, Douce Image from "Faust" (Gounod) — Mama, Quel Vino e Generoso from "Cavalleria Rusticana" (Mascagni)—Salut Demeure from "Faust" (Gounod) — Nessun Dorma from "Turandot" (Puccini).

Perhaps my critical faculties were somewhat dimmed by the pure enjoyment of listening to such a collection of excellent tunes, but at the end of the second side I was not conscious of a single defect in Mr Tucker's performance — not one instance likely to bring a frown to the reviewer's face. In restrospect, I should say that the orchestral support is a little weak, but this does have the virtue of keeping the spotlight on the principal performer. Excellent sound and stereo make this a record which the opera lover will find hard to resist. (H.A.T.)

★ ★ ★

SERENADE. Robert Tasman, baritone, accompanied by John Champ, piano and guitar. CBS mono only, BP 233393.

Interest: Varied song recital.
Performance: Excellent standard.
Quality: Very good.

It is always pleasing to see talented young Australian artists afforded the opportunity to make records and, when they come up with a record as pleasant to listen to as this one, it is to be hoped that sales will justify the confidence of the recording company. Robert Tasman is fairly well known in Sydney musical circles for his appearances in opera and

recitals, and has also sung in a number of European countries. John Champ often appears on ABC radio and television, and may be remembered as the compere of "Sunday Concert" during part of its run on TV. He has had extensive experience as an accompanist. The work of both artists is of excellent standard.

The recital here is a real pot-pourri of many different song styles in a variety of languages, comprising as it does folk songs, Lieder, art songs, musical comedy numbers and songs of the classical composer: Spanish Popular Song—Mens Je Venter—Jeg Elsker Deg—A Page's Road Song—Water Boy—Santa Lucia—Jamaican Song (Wata Come A Me Y'eye)—O Waly, Waly—Du, Du Liegst Mir in Herzen — Jabbin, Jabbin (Aboriginal Song) — Love Makes The World Go Round—Foggy, Foggy Dew—Edelweiss—Two Finnish Folk Songs (One Lovely Summer Evening and Far Away My Lover Has Gone) — Now Sleeps the Crimson Petal—The Plough Boy—Les Cloches—Die Nacht—Serenade.

Mr Tasman demonstrates his linguistic prowess by singing all songs in the original language. While this is no doubt very clever, it is a definite drawback as far as the listener is concerned, particularly as no texts with translation are provided. I believe the average listener likes to know what the song is about, however pleasant the tune. (H.A.T.).

BRIEFLY . . .

OVERTURE. The Hollywood Bowl Symphony Orchestra, conducted by Felix Slatkin. Encore, stereo SENC 9242 (or mono). Routine performances of four popular light classics: 1812 Overture (Tchaikowsky)—Light Cavalry Overture (Von Suppe) — William Tell Overture (Rossini) — Poet and Peasant Overture (Von Suppe). The orchestra plays with plenty of vigour, and their instrumental work is polished enough, but the performances are rather lacking in warmth. Sound quality and stereo are adequate. (H.A.T.).

HITS OF OUR TIME. Dot (Festival) stereo SZL-932,226. Music for dancing, but excellent for just listening as well. Polished playing by the Lawrence Welk Orchestra combined with interesting variations in arrangements make for pleasant listening indeed. The technical quality is excellent, and there is good stereo spread. Ten tracks (playing time 25 minutes), including Somewhere My Love—Georgy Girl — Strangers in the Night. (H.A.T.).

FLAMENCO FEVER. Sabicas. Ampar (Festival) stereo SML-932,228 (or mono). Strictly for the dedicated flamenco lover, this one, since it is severely classical flamenco. Master guitarist Sabicas proves again that he has mastered every aspect of the art in this recital which covers most of the main flamenco rhythms, including Alegrias, Soleares, Bulerias, Seguidilla, Fandango, etc. Eight tracks in all, playing time about 40 minutes. Excellent sound. (H.A.T.).

IN A LITTLE SPANISH TOWN, Living Brass, RCA Camden Stereo CAS-2114 and mono CAL-2114. Under the hand of Ray Martin, the boys in "Living Brass" have a musical night out in a Spanish town, ranging from brief, languid interludes to Mexican mariachi, snatches of American jazz, rock and roll, swing and calypso. Spanish Town—Tequila — Guantanamera — El Paso—La Bamba—Work Song—Cielito Lindo—Amor, Por Favor—El Mariachi Mexicano—Gotham City Swing Band. They enjoyed making it; you'll enjoy listening, when it fits your mood. Quality is O.K., stereo normal. Playing time, about 25 minutes total.

CINDERELLA. Camden (RCA) mono CAL-1085. This version of the classic children's tale has received the full American treatment, and is presented with a host of supporting characters, including talking animals and birds, and numerous songs. The best recommendation is that an eight-year-old, who was given this record for her own, has spent many happy hours playing it. Sound quality could be better but, for this type of record, this hardly matters. (H.A.T.)

Graeme Bell Says . . .

BRASS IMPACT. Command (Festival) stereo. SNDL-932-237.

Interest: Swinging brass.
Performance: Most impressive.
Quality: Full sound spectrum.
Stereo: Startling effect.

This brass choir consists of four flugelhorns, three trumpets, and four trombones. Added to this is one woodwind, three girl singers and a four-piece rhythm section plus two percussionists. The arranger is Jack Andrews and the whole thing is conducted by Warren Kime who was responsible for the idea.

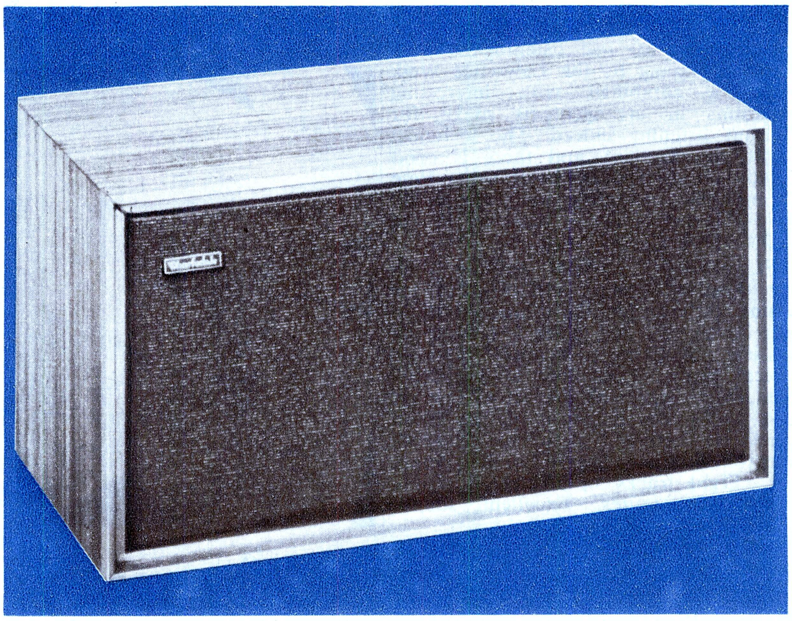
This is a most compelling album containing a varied assortment of compositions ranging from Ellington's "Prelude to a Kiss' and "A Foggy Day" to "Eleanor Rigby" by the Beatles and Henry Mancini's "Theme From Mr Lue." Doc Severinsen takes the trumpet solos and Kime himself is soloist on flugelhorn but the most notable feature is the dimensional effect obtained by Command Records who seem to lead the field in reproducing pure musical sound.

★ ★ ★

MIRIAM MAKEBA IN CONCERT. Reprise stereo RS6253.

Interest: Vocal folk artistry.
Performance: Real greatness.
Quality: Lifelike.
Stereo: O.K. by me.

The concert which produced this album took place this year at the new Philharmonic Hall in the Lincoln Centre for the Performing Arts, New York. The repertoire of this remarkable artist is drawn from all over the world thus precluding any possibility of monotony and she sings — as Leonard Feather says— in enough languages to fill her concerts with Berlitz students. Her range of ex-



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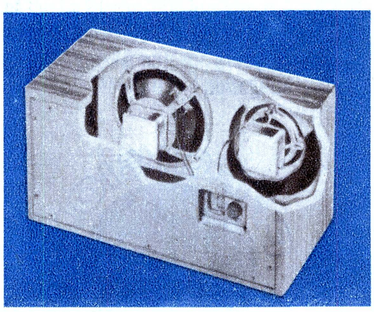

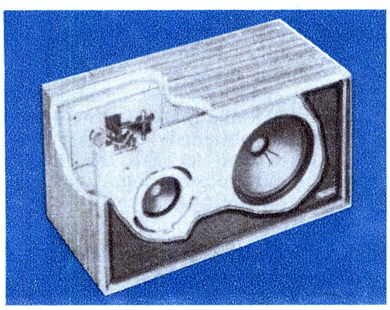

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pression keeps broadening, but I still like her best when she remains the Xosa tribeswoman in numbers such as "Jolinkomo" which is a song of courage sung by the Xosa maidens to the warriors before they go into battle. She has changed her musical accompaniment which has now taken on a somewhat cosmopolitan character by using Severio de Oleverio, a guitarist from Rio de Janeiro, who also plays accordion. Completing the trio are Leo Fleming, a percussionist from Puerto Rico and Alex Layne, a New York bassist.

All my life I've tried to like singing but to this day can count only a handful of performers who really break through to me. Miriam Makeba is one. She is something very special — something you find only once in a generation. This to my mind makes any record by her an event, and this album is just that.

★ ★ ★

RAY NOBLE: RCA Vintage Series. mono. LPV-536.

Interest: Mid-thirties.
Performance: Elegant.
Quality: Expert remaster.

Here's yet another excellent offering from RCA's Vintage Series. The choice of material is always interesting and the general production including the first-class remastering is a feature of this most worthwhile series. One could not wish for more information from the sleeve—full data on personnel, exact dates and running times of all tracks and biographical notes by someone who knows what he's talking about.

Ray Noble, an Englishman, was a composer and bandleader who took his singer, Al Bowlly and drummer-manager Bill Harty to America in the mid-thirties and landed a job in the New York's swank Rainbow-Room with a band organised for hire by Glenn Miller. This top-notch array of musicians included such names as Bud Freeman, Charlie Spivak, Will Bradley, George Van Eps and Claude Thornhill; but the big attraction was the voice of Al Bowlly, who was tragically killed in the London blitz after he returned to England. Bowlly, a intense and warm person, had already highlighted many of the English recordings made under Noble's baton and the unique quality of the voice which won him fans all over the world can be heard to great advantage on this album—particularly on those lilting versions of "The Touch of Your Lips" and "Down By The River."

This is period music of the highest order and for those of you who like myself used to dwell on each of Ray Noble's 78s as they came out, the nostalgia alone is worth the re-listening.

★ ★ ★

MANCINI '67. Henry Mancini and his Orchestra. RCA stereo LSP3694.

Interest: Big band sound.
Performance: Brilliant.
Quality: As good as you'd wish.
Stereo: Used to great effect.

As an arranger, Henry Mancini is very much at home with a jazz-oriented big band. We know him well for his background scores for films, his best-selling records and his hit compositions such as "Moon River" but the big band is his first love, stemming from his days as a young pianist-arranger in the Tex Beneke orchestra.

Here, we have five trumpets, five trombones, four French horns, five woodwinds four rhythm and two percussion. Ex Oscar Peterson, bassist, Roy Brown, works wonderfully with drummer Jack Sperling and together with Jimmy Rowles (piano) and Bob Bain (guitar) they form a most dependable and swinging rhythm section.

There is unusual treatment of Ray Noble's composition "Cherokee" where five piccolos are used. Peter Candoll takes the trumpet and Mancini himself plays the motor horn in Alpert's "Tijuana Taxi." There is some lovely piano from Jimmy Rowles in "Autumn Nocturne," the arrangement of which was inspired by an old record by Claude Thornbill. Other titles include Ellington's "Satin Doll" and Thelonious Monk's "Round Midnight" and "The House of the Rising Sun."

The studio music on this album give a wonderful interpretation of Mancini's scores and the dynamics are most exhilarating in the very "live" Dynagroove recording.

★ ★ ★

ANYTHING GOES. The Dave Brubeck quartet plays Cole Porter. C.B.S. stereo SBP223395.

Interest: Brubeck music.
Performance: Glowing.
Quality: Warm realism.
Stereo: Not important.

I shuddered before I heard this record. All the old Porter tunes of 30 years ago, churned out since by every band all over the world; sung by bad singers in worse pubs; used as opening and closing ballet sequences, and murdered by the pit orchestras playing them; used as chasers for juggling acts in nightclubs; and orchestrated by Jimmy Lally, the semi-pro dance bands benefactor.

But that's all forgotten now — or is it that the tune doesn't matter much anyway when Brubeck's playing it? For a start it's unusual for Dave Brubeck to make an album comprising anything but his own compositions, but if you like Brubeck and Desmond, I find that it really doesn't matter whether they are playing "Three Blind Mice," "I Get a Kick out of You" or one of Dave's own tunes. After all when it comes to this sort of jazz, the performer is the composer, regardless of what the title says.

You'll find all the well-known Porter tunes here — "Night and Day," "Just One of Those Things," "Your the Top," etc., and there is plenty of hard driving improvising on this album with the freedom one doesn't always encounter on some Brubeck tracks.

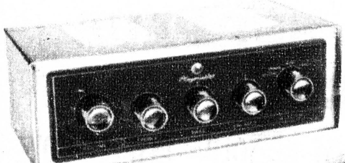
★ ★ ★

BING AND LOUIS. Encore — (E.M.I.) mono VO29233.

Interest; Bing and Louis vocals.
Performance: Balanced.
Quality: Good.

The mutual admiration society of Bing Crosby and Louis Armstrong made many appearances together, including films, TV shows and recordings and this album is a re-issue of 10 tracks made by the "Old Groaner" and "Satchmo" backed up by Billy May. It is mostly vocal but Louis plays some beautiful trumpet here and there — particularly on "Sugar," where he floats around with some glorious variations behind Bing's singing.

"Dardanella," "At the Jazz Band Ball" and "Muskrat Ramble" are some of the tracks, and the sympathy these two great stars have always had for one another and their sense of fun can be felt when listening to this happy but otherwise uneventful album. ◘



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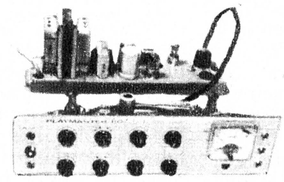

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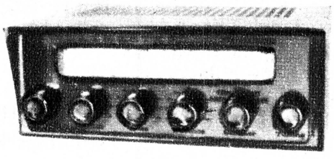

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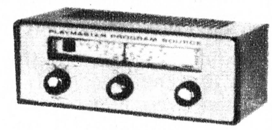

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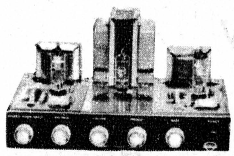

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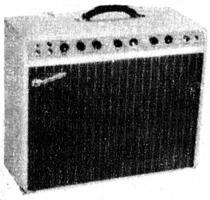

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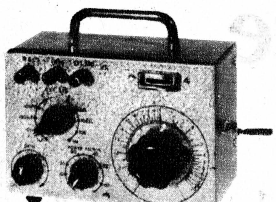

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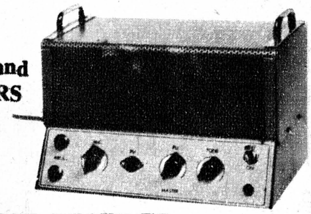
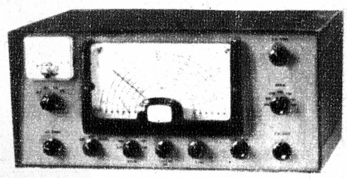


3-BAND DOUBLE-CHANGE RECEIVER
ELECTRONICS (Aust.), April, 1966.

1966 3in CRO
ELECTRONICS (Aust.), May, 1966.

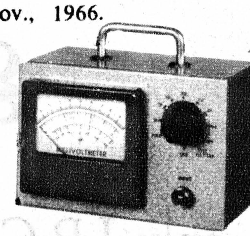
5 BAND DSB TX
Electronics (Aust.),
Nov., 1965.

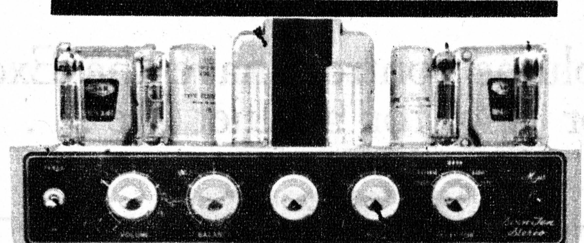


FOUR-CHANNEL AUDIO MIXER
ELECTRONICS (Aust.), Feb., 1966.

3-BAND 3-RECEIVER
ELECTRONICS (Aust.), Nov., 1966.

TRANSISTOR MILLIVOLT METER
Electronics (Aust.),
R. TV and H., Jan., 1965.





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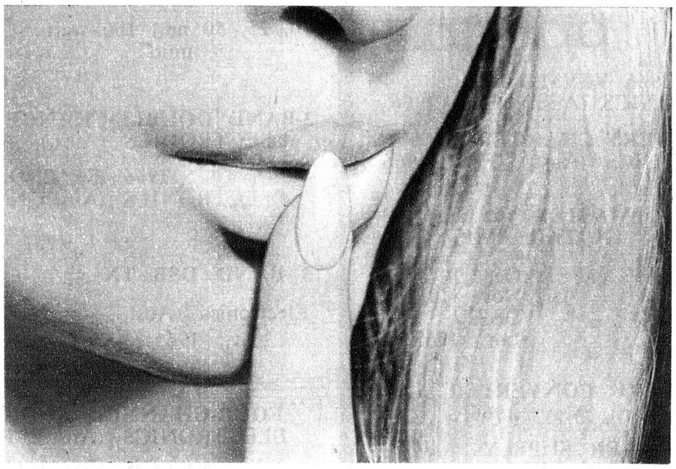

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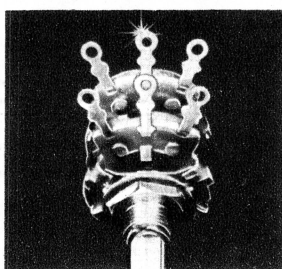

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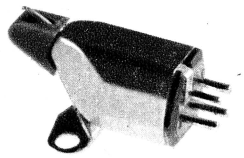
TRADE REVIEWS AND RELEASES

EMPIRE 888SE PICKUP CARTRIDGE

Messrs Recorded Music, of 23 Collins St, Melbourne, have submitted for review the latest in the Empire line of magnetic cartridges, the 888SE. Using a bi-radial diamond stylus, it lays claim to extremely wide frequency response, very high compliance and low distortion.



Through the years, Empire have offered a wide range of magnetic cartridges, for the most part representing a progressive development of the one basic theme — a very light stylus assembly integral with a moving cone in a multi-magnet assembly.

The model 888SE, distinguished by a bright blue plastic "nose," which carries the stylus assembly, is credited by the manufacturers with the widest frequency response. Actual figures quoted in their sales literature are 6-32000Hz, although this is not accompanied by any definition of the relevant dB limits.

The compliance figures quoted are also the most ambitious in the Empire range, being a very considerable 25 x 10^{-6}cM/dyne. This, combined with a low claimed (but unstated) figure of effective stylus tip mass, and a 15-degree tracking angle, holds promise of an excellent "trackability" characteristic—the ability of the stylus and cartridge to track deeply modulated grooves without displacement or serious distortion.

Of particular interest are the dimensions of the bi-radial "elliptical" stylus: A minimum radius of 0.3mil and a maximum of 0.7.

While there is sound reasoning behind the idea of a bi-radial or elliptical stylus, the actual dimensions have to be chosen in the face of certain compromises.

A large major dimension (e.g. 0.9mil in the case of the earlier Empire 888E cartridge) is an advantage in tracking grooves which are, by design or accident, wider and more extensively radiused than normal. However, the large dimension is a liability with grooves which, with modulation, become unduly narrow between the shoulders. The need for alignment becomes more critical also, involving initial assembly, mounting of stylus and cartridge relative to the head shell, and the tracking of the arm as a whole.

A small minor radius has a theoretical advantage in resolving short wavelengths (i.e. high frequencies) engraved in the groove walls. However, in terms of mass per unit area of contact, the loading would be the same as for a normal conical stylus of radius equal to the minor radius. Obviously, the rate of stylus wear must be greater than with a conical stylus of radius 0.6 or 0.7mil, unless a proportionate reduction can be made in playing weight.

In the new Empire 888SE, the radii are respectively 0.7 and 0.3, representing what is probably the best all-round compromise for the major dimension, and a minor dimension which is probably more practical than the 0.2mil figure featured in the 888PE.

Tested in an SME arm and lightweight shell, the 888SE submitted for our review yielded a frequency response which was within about plus 0.5 and minus 1.7dB over the range 40 to 10,000Hz. This was less flat than reported by "Gramophone" in their review of the same type of cartridge but it was somewhat smoother than reported by "Hi-Fi Stereo Review," whose curve may have been boosted slightly in the bass region by an arm resonance effect.

However, whereas both journals reported a treble resonance of about 3dB at 15-16KHz, the peak in our case appeared to be nearer 12KHz. This was for a playing weight of 2gm; at 1.5gm the peak was not so apparent but it is likely that this was due to less efficient groove/stylus coupling.

At all test frequencies, waveform on a CRO remained consistently good and cross-talk between channels was commendably low. Though the makers claim a stereo separation of better than 30dB, figures of this order are actually quite difficult to measure in the presence of any kind of motor or building rumble, etc., and most reviewers are happy enough to find figures of 20dB or better over most of the range. On this score, the 888SE leaves no doubts.

Transient response on square wave tracks was good and the cartridge coped well with heavily modulated grooves, although a couple of the more fiendish lateral tracks on CBS STR-110 proved too much for it at normal playing weights.

Overall, our impression was that 1.5gm would be a practical average playing weight. There would undoubtedly be plenty of recordings which the cartridge, along with others, would handle at a lesser weight but, unless one is prepared to make frequent adjustment, it is usually necessary to settle for a figure that will cope with most, if not all recordings.

Signal output is about average for magnetic cartridges and should present no problems with connection to magnetic pickup preamps. having an input impedance of about 47,000 ohms.

No trouble was encountered with hum pickup and it would appear that integral shielding is sufficient to cope with the kind of hum fields that are likely to be found adjacent to typical playing decks.

No significant magnetic leakage is apparent from the cartridge itself and it may be used with ferrous or non-ferrous turntables, as desired.

Finally, how does it sound?

Exactly as one would expect a cartridge of this quality to do! Reproduction is smooth and clean and the cartridge copes well with heavily modulated passages. In fact, over the past couple of years, we have given the earlier 888P a pretty solid workout and there is every reason to expect that this most recent addition to the range will give an even better account of itself. (W.N.W.).

Solartron in Australia

SOLARTRON AUSTRALIA has been formed, with headquarters at 112 High Street, Kew, Victoria, as part of the Solartron Electronics Group of U.K. They will market in Australia the Solartron range of instruments, which include oscilloscopes, digital instruments, general electronics instruments, dynamic analysis instruments, transducers, data logging equipment and analogue computers. The Solartron Group is part of the large international Schlumberger Company, and Solartron Australia will also market the products of a number of other Schlumberger subsidiary companies.

These include G.P. digital computers, high speed data logging, telemetry, photomultipliers, and rotary encoders from E.M.R. of U.S.A.; digital instruments, counters, flow metering equipment, transducers, non destructive materials testing equipment and data logging from Rochar, of France; precision frequency measuring and recording equipment from precision signal generators, synthesisers, radar and communication system test and evaluation systems from Schlumberger GMBH of Germany; data tape recorders, digital magnetic tape systems, from Tolana of France.

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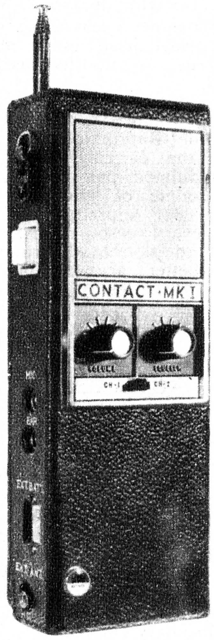

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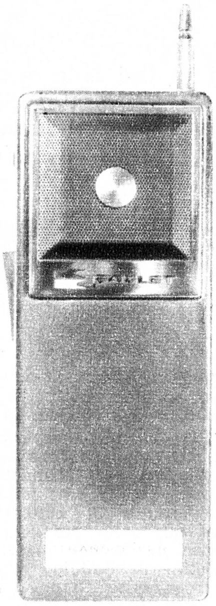

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UA70—A NEW AUTOMATIC/MANUAL TURNTABLE FROM B.S.R.

A newcomer to the audio field is the B.S.R. UA70 automatic/manual turntable which offers features not previously available with units in its price range.

Those setting up an audio system on a limited budget will appreciate the features of this new turntable from the B.S.R. company, since it represents a reasonable compromise between price on the one hand and performance on the other. The UA70 is pleasingly styled in the popular satin black and brushed aluminium finish. The 11in diameter pressed steel platter is basically satin black, and the black rubber mat has inlaid brushed aluminium rings. Accessories supplied as standard are interchangeable spindles for automatic or manual operation, four plastic mounting feet and a full-size paper template for making a mounting baseboard.

The unit has all the usual facilities of the automatic turntable: changing mechanism with capacity up to eight records: four speeds (78, 45, 33-1/3 and 16-2/3 rpm); automatic cycling and shut off. However, the unit has a number of features not usually found in lower priced turntables. It has a low mass tubular metal arm with coarse and fine counterweight adjustment for setting static balance, and a dial type adjustment for setting playing weight; a "cueing lever" for raising and lowering the arm, which allows manual operation without the risk of damage to stylus or disc; and an arm lock which automatically clamps the arm to its resting column when the operating lever is in the OFF position.

Horizontal ball bearing pivots are fitted to the arm bearings to keep arm friction to a low order, although our tests indicated that friction is still rather higher than that of the separate arms sold for use with transcription units. The normal type of four-pole motor is used, suspended on butyl rubber mountings to minimise rumble. Drive is transmitted to the turntable rim by a rubber idler wheel which is automatically disengaged when the unit is stopped, thus preventing the formation of "flats."

There is no provision for mixed operation for discs of different sizes, and the user selects the playing diameter by means of a lever. Playing speed is selected in the same manner. The other operating control has OFF, START and REJECT positions.

Although designed as an automatic changer, the UA70 can be used as a manual unit, and is supplied with a separate centre spindle for this purpose. The cueing lever is, no doubt, also intended primarily for the person wishing to use the unit manually.

The arm has a removable headshell (rather difficult to remove and replace, incidentally, because of the inconveniently positioned fixing screw) and this is fitted with a small plastic plate upon which the cartridge is mounted by standard ½in centre holes. Unless otherwise specified, the unit is supplied with a ceramic cartridge (B.S.R. C1) and diamond stylus. For those requiring a higher standard of performance than can be obtained from the relatively inexpensive ceramic cartridge, the distributors recommend a magnetic cartridge such as the Pickering V15/AM2. If required, they can supply this cartridge already fitted.

We did at first have some reservations about the use of magnetic cartridges with this turntable for two main reasons: The arm sets down rather heavily, particularly at the 45rpm and 78rpm speeds and, even at 33-1/3 rpm, we felt the set-down was rather too fast for other than a "ruggedised" magnetic cartridge. Also, the arc of the arm carries it quite close to the plane of the motor, with the possibility of induced hum from the magnetic field.

We accordingly fitted a medium quality magnetic cartridge, and connected the turntable to a wide-range amplifier for music listening tests. Under these conditions there was no noticeable hum, neither was there any detectable rumble or distortion from wow and flutter. We do, however, recommend that those using a normal magnetic cartridge should make sparing use of the automatic changer facility, for preference operating the unit manually by means of the cueing lever.

As a matter of interest, we point out that at least one prominent supplier of audio equipment in the U.S.A. supplies a complete system using this turntable fitted with a magnetic cartridge. (The UA70 is known in the U.S.A. as the B.S.R./Macdonald.)

Our tests also indicated that about 2½ grams playing weight is required for satisfactory operation with the type of medium quality magnetic cartridge suggested by the distributors. On the other hand, all of 5 grams is normally necessary for the ceramic. These results were obtained with discs having a reasonable amount of modulation, and it may be necessary to go higher for heavily modulated discs.

The turntable platter showed slight warping, but not more than is common with the pressed steel type of construction and, in any case, not sufficient to affect operation. As already mentioned, the automatic mechanism sets down rather heavily, and in our opinion too heavily for continuous operation with a non-rugged magnetic cartridge. Even with the ceramic cartridge, set up for a playing weight of five grammes, some bouncing was noticeable at the 45rpm speed, and more still at 78rpm. The cueing lever is situated at the usual rather inconvenient place at the base of the arm spindle. On the sample unit, the lever did not return to the rest position itself after release, but tended to support the arm, thus effectively reducing the playing weight and impeding normal tracking movement. The lever had to be firmly pushed down to ensure correct operation.

To summarise, this is not the turntable for the person seeking the ultimate in high fidelity but, in the context of ceramic cartridges and matching quality amplifiers and speaker systems, should provide excellent service. We found it to perform quite satisfactorily with a magnetic cartridge subject to the safeguards mentioned. It fills the gap between the low-priced turntables, as fitted to commercial radiograms and the expensive transcription units and, as such, should find a ready market among that large body of buyers who want something better than average but cannot afford the best.

Goldring Engineering, who are the Australian distributors of the UA70, advise that the retail price of the turntable alone, without cartridge, is \$43.75. Fitted with the B.S.R. C1 ceramic cartridge and diamond stylus, the price is \$47. Goldring recommend the Pickering V15/AM2 for those requiring a magnetic cartridge, and this can be fitted for an extra \$26. All these prices are inclusive of sales tax. The UA70 should be available from the usual retail and trade channels, or direct from the distributors at 443 Kent Street, Sydney.

For those intending to make up a unit amplifier system in conjunction with the UA70, Goldring are making available a special base, in teak finish, fitted with a Plexiglass top, with suitable cutout for the unit. We have not yet seen this base, but we understand there will be room under the turntable for a small amplifier. The base, with cover, will sell for \$30 retail. (H.A.T.)

RESLO PROFESSIONAL MICROPHONES FROM BRITISH MERCHANDISING

The type SR1 studio ribbon microphone pictured is representative of the comprehensive range of professional quality microphones manufactured in the U.K. by Reslosound Limited and distributed in Australia by British Merchandising.

Other models in the range include a broadcasting-quality miniature ribbon (type VRT), a semi-professional miniature ribbon (type RB), a cardioid ribbon (type CR2), a "lavalier" ribbon (type RL1) and a semi-professional pencil dynamic (type PD).

The model SR1 professional type ribbon was recently developed by Reslo for use by broadcasting authorities and professional recording studios. It features a larger magnet assembly and longer ribbon than usual for improved sensitivity, together with a minimum of internal protective screening in the interests of extended frequency response. Specifications of the unit are thus most impressive, with a 300ohm sensitivity of -73dB below 1V/dyne/cM^2 and a frequency response of 30-20,000Hz plus/minus 2dB. The nominal directional response characteristic is the usual "figure 8" pattern, although both the frequency and directional characteristics may be restricted for speech use by means of acoustic damping pads supplied with the instrument. Alternative output impedances are available, a suffix "M" signifying 250-300 ohms and an "L" signifying 30-50 ohms.

Size of the SR1 is quite small, the frame width being 1½in while the overall height of microphone and transformer base is 5-78in; head weight is 11oz (0.312Kg). The case has a non-reflective satin bronze finish. The microphone is supplied complete with a matching Reslo mounting plug unit fitted with 18ft of sheathed screened and twisted cable, a set of fitting adapters, a polished and padded wooden storage case, acoustic damping pads and an instruction booklet giving an average response curve.

Connected in our laboratory to a high-quality amplifier and loudspeaker system, the performance of the sample SR1 sent for review gave strong support for the manufacturer's specifications. Response was extremely smooth and well balanced, and sensitivity was quite impressive while vibration sensitivity was low. (A full instrument check was not feasible as the performance of the microphone exceeds that of our acoustic testing facilities.)

Quoted price of the SR1 is $110.40 plus 12½ p.c. sales-tax where applicable. For further information on Reslo microphones and the comprehensive range of accessories also available, inquiries should be directed to British Merchandising Pty. Ltd. at Shaw House, 49-51 York Street, Sydney. (J.R.)

VARIABLE LOW-VOLTAGE SUPPLY

SWE-CHECK INSTRUMENTS market the variable low-voltage regulated power supply shown, which is intended for general purpose operation and servicing of low-voltage equipment, and also for battery charging. Called the "Zen-Tra-Stab," the unit can supply up to 15VDC variable in two overlapping ranges, at up to 40 watts load and with a ripple of less than 1 p.c. The output is stabilised against mains voltage variations of up to about 15 p.c. and is continuously monitored by a voltmeter and ammeter on the front panel. A thermal cut-out gives protection against sustained overload. The output is fully floating above earth.

The circuitry of the unit is along conventional lines, employing the cascaded emitter-follower principle, and under test in our laboratory it performed substantially as claimed. On this score we had no misgivings.

The case in which the instrument is housed is of steel with a covering of grey, bonded plastic cloth. The panel is black, with lettering in natural aluminium, as shown, and with red pickout for the name and terminal connectors.

However, internal inspection of the unit supplied for review — which may have been a prototype — suggested a need to improve the mechanical construction if the unit is to withstand any kind of rough handling.

Particularly disappointing was the way in which the heavy mains transformer is fastened to the case by only a light sheet-metal bracket and two small screws along one edge. This is quite inadequate and, in the sample unit, the bracket had already been distorted in transit to our office. In normal laboratory and service workshop use it is likely that the transformer would eventually come adrift and damage other components. A more secure method of mounting would be highly desirable.

Also questionable is the way in which the heat-sink extrusion plate is fastened to the case via four small "self-tapping" screws engaging into small Perspex blocks. From a servicing viewpoint this seems rather poor construction, since the hole in the plastic would probably strip all too easily.

Inside the case there are also a number of examples of "floating joints," despite the fact that there are a number of unused tags on the resistor panel used to support the minor components. Making better use of the tags would probably give a worthwhile improvement in ruggedness and reliability.

Price of the unit is quoted as $84 plus 12½ p.c. tax where applicable, and the postal address of the manufacturer is P.O. Box 16, Balaclava, Victoria. (J.R.)

TRANSISTORISED FM RADIOTELEPHONE

What is believed to be the first fully transistorised VHF FM radiotelephone to be made in Australia is now being marketed by Telecommunication Company of Australia Pty. Ltd.

The unit is designed to meet Australian Post Office requirements for narrow band (30KHz) systems, but can be supplied for use in existing wide band (60KHz) systems. Models with output powers of 10W and 25W are available. The unit operates from a nominal 12V DC source, but optional extras enable operation from 24V or 32V DC sources. Units can be ordered for multi-channel operation (up to 6 channels) or converted later to provide this facility. Electronic muting is standard to all units.

A high order of reliability has been achieved in the design by the elimination of thermionic devices, and attention to reliability factors in the design of the equipment.

A high proportion of the solid state devices used are of the rugged silicon types. Other factors contributing to reliability are the conservative rating of components; the almost exclusive use of printed wiring cards; and the choice of an aluminium die-cast housing to make the set dust proof, insect proof and splash proof.

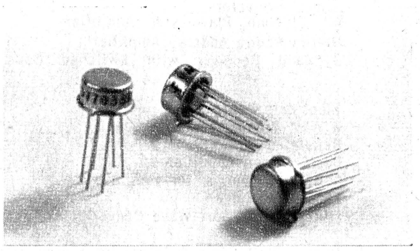
The unit is extremely compact—case dimensions excluding projections being 9-1/8 x 9¼ x 2¾in—and thus may be mounted under the vehicle dashboard without difficulty. Included with each unit is a flexible stainless steel whip aerial.

The following ancillary items are available for use with the unit. "Clearline" rejects messages from other systems sharing the channel allowing only the user's messages to be heard. Vehicle Selective Alarm enables the base station to attract an absent driver's attention by sounding an alarm or the horn. Selective Calling System provides the facility to individually call up to 120 vehicles.

Further information can be obtained from the head office at 113 Tapleys Hill Road, Hendon, South Australia, or from offices and agents throughout Australia.

FAIRCHILD'S NEW LOW-COST LINEAR INTEGRATED CIRCUITS

Fairchild Australia Pty. Ltd. has announced availability of three new low-cost linear integrated circuits. The prices of these show a marked reduction on previously available types.



The three types so far made available in the low price range are the uA702C high gain wideband DC amplifier, priced at $12 each; the uA710C high speed differential comparator, $7.50 each; and the uA703C RF-IF amplifier, $4.10 each. The usual substantial discounts apply for quantity purchases.

Brief technical data on these three types follow.

uA702C High-gain wideband DC amplifier. This is a complete DC amplifier constructed on a single silicon chip, using the Fairchild Planar epitaxial process. It is intended for use as an operational amplifier in miniaturised analogue computers, as a precision instrumentation amplifier, or in other applications requiring a feedback amplifier useful from DC to 30MHz.

ABSOLUTE MAXIMUM RATINGS

Max. total supply voltage between V + and V — terminals	21V
Peak output current	50mA
Maximum internal dissipation TO-5	200mW
Flat pack	150mW
Operating temperature range	0-70 deg. C
Differential input voltage	plus or minus 5V
Input voltage	plus or minus 1.5 to 6V

uA710C High-speed differential comparator. This is intended for applications requiring high accuracy and fast response times. It is constructed on a single silicon chip using the Fairchild Planar epitaxial process. It is useful as a variable threshold Schmidt trigger, a pulse height discriminator, a voltage comparator in high-speed A-D converters, a memory sense amplifier or a high-noise immunity line receiver. The output for the comparator is compatible with all integrated logic forms.

ABSOLUTE MAXIMUM VALUES

Positive supply voltage	14V
Negative supply voltage	7V
Peak output current	10mA
Differential input voltage	plus or minus 5V
Input voltage	plus or minus 7V
Internal power dissipation TO-5	300mW
Flat pack	200mW
Operating temperature range	0 to 70 deg. C

uA703C RF-IF amplifier. This device, constructed on a single silicon chip, is intended for use as a limiting or non-limiting device, harmonic mixer, or oscillator to 150MHz. The low internal feedback ensures a higher stability-limited gain than that available from conventional circuitry. The biasing network is included in the same package, thereby reducing the number of external components required, and increasing reliability and versatility of the device.

ABSOLUTE MAXIMUM RATINGS

Supply voltage	20V
Output collector voltage	24V
Voltage between input terminals	plus or minus 5V
Internal power dissipation	200mW
Operating temperature range	0 to 70 deg. C

Further details and technical literature can be obtained by writing to Fairchild Australia Pty. Ltd., 420 Mt. Dandenong Road, Croydon, Victoria.

Philips Capacitors

Philips Miniwatt draw attention to their range of C281 capacitors, which should be of particular interest to manufacturers of custom built and high grade communication or other equipment where reliability is a major requirement.

The C281 is a metallised foil type capacitor, using both polycarbonate and polyester foils. Advantages of the metallised foil type capacitors are small physical size and self healing properties in the event of a breakdown. Further advantages are provided by the polyester and polycarbonate dielectrics, such as low temperature coefficient, very high resistance—normally in excess of 30,000 megohms—and high reliability.

These capacitors are made in a wide range of capacitances and voltage ratings. Currently available are 100V polycarbonate types ranging from .068uF to 5.6uF in preferred values, 250V polyester types ranging from .01uF to 2.2uF, and 400V polycarbonate types ranging from .01uF to 1.0uF.

Due to become available in the near future are 630V, 1000V and 1600V polycarbonate types ranging in value from .01uF in all cases to .47uF, .15uF, and .068uF respectively. Tolerances are 10 p.c. or 20 p.c. for all types.

Philips also draw attention to type C280, which is a lower cost version of the C281. The difference is mainly in the shape and finishing material, the capacitor being otherwise similar in performance to the C281.

Both capacitors are dearer than the conventional polyester capacitors of the same voltage and capacitance values, the C280 by about 15 p.c. and the C281 by between 30 and 35 p.c. However, the higher cost of either type is fully justified where the special qualities of these capacitors can be used to improve the performance of the equipment.

Further details of these capacitors may be obtained from the Miniwatt Electronics Division, Philips Electrical Pty. Ltd., 20 Herbert St, Artarmon, N.S.W.

TRADE RELEASES — IN BRIEF

ASTRONIC IMPORTS has stocks of a 4-port fail-safe coaxial transfer switch (model F7223), newly developed by Sage Laboratores, Inc. in the U.S.A. This will provide 1.2 VSWR (max.) with 0.2dB insertion loss (max.), and 50dB isolation (min.) from DC to 1.4MHz. Operation is remote (solenoid drive) with a switching time of 10mS (max.).

Also from Astronic Imports comes news of additions to the range of miniature mircrowave balanced mixers with replaceable diodes manufactured by Sage Laboratories, which has now been expanded to 16 models. The new line covers 1—12GHz in four bands. The new models have the following specifications: VSWR typical 1.5-1.7; minimum isolation 6dB; typical noise figure 9dB. Also available are various high-performance coaxial electromechanical switches with special form-factors to meet virtually any packaging requirement. Inquiries to the head office at 622-626 Nicholson Street, North Fitzroy, Vic., or offices in other States.

AMALGAMATED WIRELESS (AUSTRALASIA) LTD. announces that the Engineering Products Division has moved to 422 Lane Cove Road, North Ryde, N.S.W. The postal address is P.O. Box 96, Ryde 2112. The new telephone number is 88-6666.

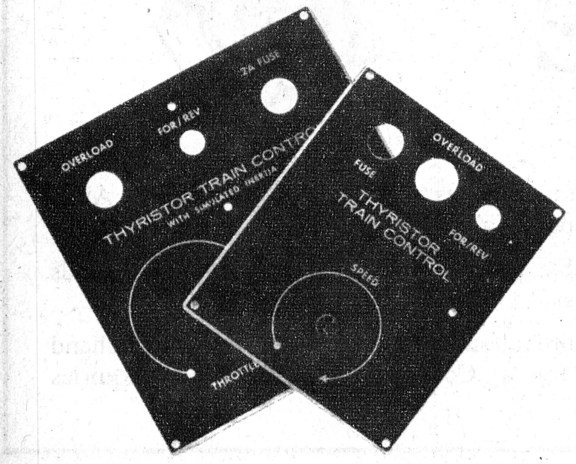
RACAL ELECTRONICS PTY. LTD. has pointed out that the Racal Universal Counter-Timer reviewed in the April, 1967 issue has a sensitivity of 100mV and not 100V as published.

ELECTRONIC INDUSTRIES LTD. recently announced that it had sold its 50 per cent investment in Anodeon Ltd., of Auckland, New Zealand, to EDAC (Electronic Development and Applications Co. Ltd.) of Wellington, for a cash consideration.

BROADWAY ELECTRONICS PTY. LTD. has announced the availability of a range of all-over labels which are suitable for the Playmaster 112, 115 and 117 Amplifiers. They can be obtained in the following styles and sizes:

Silver-white with brown letters, 12½in x 4½in, $2.80.
Silver-white with brown letters, 11¼in x 3 3/8in, $2.80.
Gold with black letters, 11¼in x 3 3/8in, $2.00.

Inquiries should be addressed to the company at E.S. & A. Bank Building, Corner Broadway and City Road, Sydney, N.S.W.



Heating Systems have produced etched labels for both the Model Train Controllers described in recent issues. (February and March, 1967). They are screen printed on 19 gauge aluminium and will add a professional touch to the hobbyist's work. Sloping front cases to fit these panels are also aavilable. Further details, prices, etc., from Heating Systems Pty. Ltd., 24-32 O'Riodan St., Alexandria, N.S.W.

PLESSEY AUTOMATION has developed data transmission systems specially designed for use in commercial establishments where there is a low volume of information to be communicated. It can be operated in either the simplex or duplex mode , and other features claimed are clean tape output, reliability and low cost. Transmission of 18.2 characters per second may be over public telephone networks or over private wire circuits. The equipment can be switched to handle any five, six or seven channel code, or an eight channel code containing a parity bit. Further information is available from Plessey Automation, 13-17 Botany Street, Redfern, N.S.W. 2016.

RACAL ELECTRONICS PTY. LTD. has sent details of its new TRA 905 100W single-sideband transistorised radio transreceiver. This has been designed for use in radio telephone systems where high reliability and stability are required, and is capable of providing clear telephone-quality communications for remote parts of Australia and other areas where it is not practical to install land lines. The frequency stability is such that stable operation over periods of several months is possible without the need for adjustments. The transceiver is rated for full operation from -10 deg. C. to 50 deg. C. Weight is only 42lb.

The TRA 905 covers a frequency range from 2 to 12.5MHz, using lower sideband SSB telephony. The mode of operation is essentially simplex but different frequencies may be used for transmission and reception. Two channels of two frequency simplex or four channels of single frequency simplex operation are available. Channel switching may be performed at the front panel controls. Extended or remote control is available so that the transceiver can be situated away from the telephone and control unit. Further information can be obtained from the company at 75-77 Chandos Street, Crow's Nest, N.S.W.

AURIEMA (AUSTRALASIA) PTY. LTD. has established offices at 443 Kent Street, Sydney, N.S.W. It is a member of the Ad. Auriema international group and represents the following American companies:

Aerovox Corp. (manufacturers of capacitors, resistors, and attenuators); Apelco Co. (marine and general equipment); Barber-Colman Co. (relays, motors, and control systems); Electronized Chemicals Corp. (laminates, dielectrics and insulants); E.R.A. Acoustics Corp. (speakers); Kepco Inc. (power supplies); Knight Electronics Corp. (kitsets and educational kits); James B. Lansing (amplifiers, pre-amplifiers and speakers); Micro-State Electronics Corp. (microwave semiconductors); National Company Inc. (radios and power supplies); Omni Spectra Inc. (microwave components); Rotron Manufacturing Inc. (fans and blowers); Sanders Associates Inc. (microwave components); Sarkes Tarzian Inc. (semiconductors); Sigma Instruments Inc. (relays and magnetic amplifiers); Stackpole Carbon Co. (resistors, capacitors, switches and ceramic magnets); TEL Instrument Electronic Corp. (electronic equipment for laboratory, commercial and communications uses); The Turner Company (microphones); Uniform Tubes Inc. (microwave coaxial cable and delay lines); Western Microwave Laboratories Inc. (microwave components).

Further details may be obtained from Auriema (Australasia) Pty. Ltd.

MINNESOTA MINING AND MANUFACTURING (AUSTRALIA) PTY. LTD. (the 3M Company) announces a new computer tape, called "Scotch" Brand No. 777. It is certified error-free at all packing densities up to and including 1600bpi. A special oxide binder formula enables the product to deliver greatly extended error-free performance under heavy usage as well as the temperature and humidity extremes encountered during shipping and long time storage. The company feels that it is a breakthrough in terms of its extended performance reliability. Further details can be obtained from the 3M Public Relations Department, at 2 Wentworth Avenue, Darlinghurst, Sydney, N.S.W.

ANDREW ANTENNAS PTY. LTD. are to manufacture microwave dish antennas in their new plant at Henty Street, Reservoir, Victoria, and will also stock co-axial cable and wave guide. All future inquiries for Andrew products should be directed to the head office at 437 St. Kilda Road, Melbourne.

Andrew Antennas also announces the appointment of Mr Christopher Lin, A.I.E.A., as sales engineer. Formerly with the radio division of the P.M.G., he will assist in the marketing of microwave dish antennas and antenna systems equipment.

AUSTRALIAN GENERAL ELECTRIC PTY. LTD. has notified the availability of the following semiconductors.

The GE type L1V is a planar PNPN light activated silicon controlled switch that features an "extra lead" which is claimed to completely eliminate rate effect (dv/dt) and voltage transient problems without compromising triggering sensitivity or transient response. The L1V is expected to be particularly useful in applications such as optical tape and card readers, isolated switching and counting. The trade price is $3.98 each for 1-9 quantities.

The GE type D5K1 complementary unijunction transistor operates in an opposite polarity mode as compared with standard unijunctions, and can produce both a negative and a positive trigger pulse. Increased stability is claimed for the device which can be built into oscillators up to 100 KHz. The trade price is $8.75 each for 1-9 quantities.

The GE type D5E29 is a new economy silicon unijunction transistor. It has a maximum power dissipation of 300mW and a peak emitter current of 2A. The maximum emitter reverse voltage is 30 volts, while the maximum interbase voltage is 35 volts. The intrinsic standoff ratio is 0.68 to 0.82 and is essentially constant with interbase voltage. The trade price for 1-9 quantities is $1.32 each.

For further information and specifications on any of these devices contact the company at 103 York Street, Sydney, or at 552 Lonsdale Street, Melbourne.

PLESSEY has announced the appointment of Mr Robert R. Long as Deputy General Manager (Engineering and Production) of the Telephone and Electrical Industries (T.E.I.) Division of Plessey Telecommunications. He has resigned his position as Assistant General Manager (Technical) of the Overseas Telecommunications Commission (Australia) to take up his new appointment. Mr Long joined the O.T.C. in 1953 after 14 years with STC Australia as a design engineer responsible for telecommunication systems.

Mr Long holds an Honours Bachelor of Electrical Engineering degree from Melbourne University. He is a Fellow of the Institution of Electrical Engineers, Member of the Institution of Engineers Australia, and Senior Member of the Institution of Radio and Electronics Engineers Australia. He will be located at the headquarters of the T.E.I. Division at Meadowbank, N.S.W.

Mr Daryl E. Hooper has been appointed to the senior engineering staff of the Central Research and Development Laboratory operated by Plessey Pacific Pty. Ltd. at North Melbourne. Prior to his new appointment, Mr Hooper was senior lecturer in electrical engineering at Melbourne University. Before that he was a research associate with the U.K. Atomic Energy Commission at Harwell and a research engineer with the G.E.C. Research Laboratories in U.K.

EIMAC DIVISION of Varian has introduced a new line of miniature planar triodes for advanced airborne and space applications. The valves are of rugged ceramic/metal construction and feature large contact areas for improved electrical paths. They use arc-resistance cathodes and are claimed to provide high-frequency efficiency through the S-band. Cooling is by forced air or heat sink. For further information contact Varian Pty. Ltd, 38 Oxley Street, Crow's Nest, N.S.W.

EMERSON AND CUMING, INC. of Canton, Massachusetts, U.S.A., has released information on the following new products.

Eccosorb FGM is a 1/8in flexible microwave absorber based on silicone rubber. It is claimed to have an average reflectivity of 12dB down from 2 to 12GHz over a wide range of incidence angles.

Ecco Reflectors, devices based on the Luneberg Lens, are spherical passive devices which reflect and return to its source a radar signal almost as effectively as a flat metal plate of the same diameter. They are capable of reflecting simultaneously radar signals from many directions over a broad viewing angle.

Details may be obtained from Australian agents, Wm. J. McLellan and Co. Pty. Ltd., The Crescent, Kingsgrove, N.S.W.

TUDOR RADIO

L. E. CHAPMAN

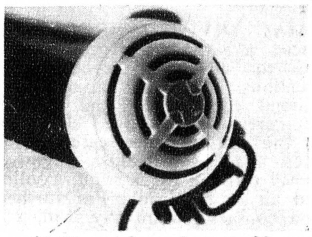
ESTABLISHED 1940

103 ENMORE ROAD, ENMORE, N.S.W.

PHONE 51-1011 **PHONE 51-1011**

Knobs long shaft, push on. Dozen **$1.20**
Knobs for concentric shaft. Dozen **$1.20**
250 mixed screws. BA, Whit., self-tapper bolts, nuts, etc. **$1** bag plus **25c** post.
Crystal microphones, good quality, ideal tape recorders, etc. **$2.80.**
Transistor speaker transformers, single ended, 5 watt. **$1.50.**
Dutch Philips 3 pin flexible jacks, **40c** each.

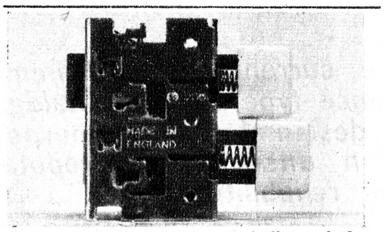
ZEPHYR — CRYSTAL MICROPHONE



$2.50, pack and post 20c.

SPEAKERS

MSP 20928 mod 12 PQ	**$13.50**
MSP 8in twin cone 15 ohm	**$5.50**
MSP 12in twin cone 15 ohm	**$7.50**
MSP 7 x 5, 3 and 15 ohm	**$3.50**
MSP 3½ inch	**$2.00**
Rola 5 x 4, 3 and 15 ohm	**$2.50**
Rola 4 x 3, 10, 15, 27 ohms	**$2.00**
Rola 5 B 3 ohms	**$2.00**
Rola 8 x 4 15 ohm	**$3.50**
6 x 9 single cone 15 ohm	**$3.50**
8 inch single cone 15 ohm	**$4.20**
3½ inch 47 ohm	**$2.00**
6 x 4 33 ohm	**$2.50**
2 x ¾, 15 ohm	**$2.00**
5 x 3, 47 ohm	**$2.00**
5 x 3, 27 ohm	**$2.00**
12P.G. M.S.P. 21622 20 watts	**$17.50**



English push-button on/off switches, **75c each. Pack and post 10c.**

Mini cable, 4 strand shielded, lots of uses, including microphone cable, extension speakers etc. ...... **10c** yard
Radio knobs, push on ... **50c** doz.
Miniature valve sockets 7 and 9 pin **15 cents** each.
Picture tubes, all sizes, new in cartons. **$25.00.** With your dud. Bonded extra.
Philips IFT's 455KC .... **75c** each
Aerial and oscillator coils .. **50c** each

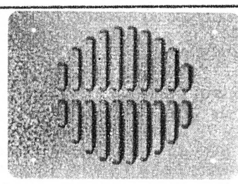
Scope soldering iron, standard; mini scope. Scope De Luxe. Vibra scope; National scope transformer.

Vinyl insulating tubing, 13MM wall thickness .030, 25 yards .. **$1**

Transistor IFs, medium size, **75c** each

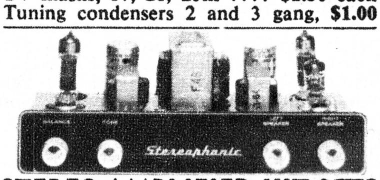
Record Changers. Garrard AT 6

Transistor Amplifier and tuner, new working **$10**
Speaker .... **$2** extra



Steel speaker baffle unit 6 x 9, 7 x 5 speaker, **$1.00.**
Pack and post 15c.

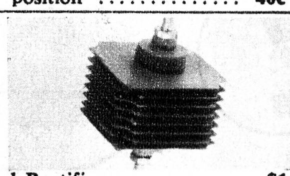
Transistor speaker and drive transformers, large and midget type .. **$1.00**
Speaker transformers 15,000 and 25,000 to 3 ohms 6 watts .... **$1.50** each
5,000 to 3 and 15 ohms .. **$1.25** each
Transistor speaker chokes .. **$1.50** each
Here's value in pots.
Pots, single log and linear:
3K, 7½K, 10K, W.W., 20K, 25K, 50K, 100K, 200K, 250K, 500K, 1 Meg, 2 Meg. .... **50c** each
1.5 Meg. Dual Concentric .. **$1.00**
Pack and post 50c.
Pots dual ganged 10K, **50c.** 1 Meg. **$1.25**
Pots concentric. 100K + 50K, 100K + 2½K, 100K + 10K, 250K + 250K, 500K + 500K, 1 Meg + 1 Meg., 1 Meg. + 500K. Various others **50c** each
TV power Transformers 300 mill 225v a side, suit amplifiers up to 50 watts voltage doublers available, **$8.00** each
TV safety glass per sheet ... **$3.50**
Garrard plug in stereo heads **$4.00**
TV masks, 17, 21, 23in .... **$1.50** each
Tuning condensers 2 and 3 gang, **$1.00**



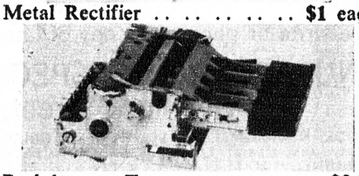
STEREO AMPLIFIER KIT SETS

Without Speakers $5 less.

TU 10, 3.5 watt per channel .. **$24.00**
TU 11, 3.5 watt per channel has facilities for tape and microphone channels, **$28.00**
TU 12, 5 watt per channel .. **$27.00**
TU 13, 5 watt per channel with TU 11 facilities **$32.00**
Each kit set includes valves, speakers and all components.
Single stage amplifier kit set:
5 watt per channel **$22.00**
Transistor ear plugs .... **3 for $1.00**
Tag strips, mixed types .. **Dozen, 60c**
Switches, oak 4 position .. **50c** each
2 position .... **40c** each



Metal Rectifier .... **$1** each



Push-button Tuner **$3.50**

TV AERIALS

Famous Make
All types **$3.50** to **$20.00** plus post.
TV aerial lead in .... **8c** yard
TV aerial chimney mount kits .. **$3.50**
Wall stand-off brackets, pair .. **$1.90**

HEAVY DUTY 3 CORE FLEX
50yds, $2.50

THREE WATT AMPLIFIERS,
complete with speaker.
NEW. $10.00

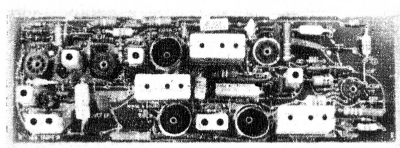
2 amp fuses .... **$3.50 per 100**
Special, 12in speaker, 2 ohm Rola, **$6.00** pack and post, **75c.**
Transistor plastic outer case, **50c** each
Transistor carrying straps .. **20c** each
Stereo pick-up arms, with Xtal, **$6.00** ea.
Metal rectifiers for battery and electric portables .... **50c** each, post. **10c**
Pilot lamp holders ...... **30c per doz.**
TV or cabinet castors .... **4 for $1.00**
100 Mixed Knobs including TV channel changers **$10.00**
240v AC Record Changers, stereo **$21.50,** Mono **$20.00.** Pack and post, N.S.W. **$1.50,** interstate **$2.50.**
Gramophone motor and pick-up, 240v AC **$11.50.** Pack and post, N.S.W. **$1.00,** interstate **$1.50.**
OA 70 diodes .... **40c** each
Morganite and IRC resistors. At least 33 values. Suit transistors, radios, TV, etc., **$2.00 per 100.** Pack and post, **25c.**
3, 5, and 10 Watt IRC wire wound resistors. Many values.
20c each, **12 for $2.00**
100 mixed condensers, micas, ceramics, tubular. Fresh stock.
$2.00. Pack and post **25c.**
50 + 24, 350 vw + 100 mf 25vw, **75c** each
30, 30mf 300 vw 350vp .. **75c** each
Many others. Invaluable for service.

SHEPHERD CASTORS, **$3.00 set of 4.**
SMALL AMPLIFIER OR TUNER CHASSIS, **$1.50** each. Pack and post **25c.**
ALPHA 200VAC ½ amp push-on switches, **30c** each. Ideal for fridges.
90 deg. PICTURE TUBE SOCKETS **25c** each. 152 valve sockets, **25c** each.
Transistors AC127, 2N384, 2N217, 2N218, OC71, OC75.
$1.00 each. Post and pack **5c.**

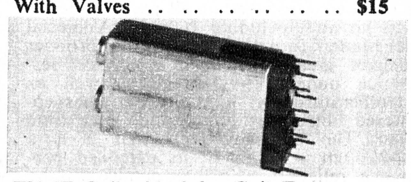
TRANSISTOR CLOCK RADIOS, LIMITED QUANTITY, famous make, **$50** each

VALVES

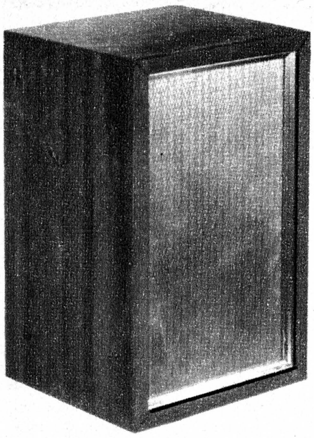
12AU7	**$1.25**	6CJ6	**$1.50**
12AX7	**$1.25**	12BH7	**$1.25**
6SA7	**$1.25**	6L18	**$1.00**
6V4	**.90**	ECL85	**$1.25**
6BU8	**$1.25**	SP61	**$1.00**
6M5	**$1.25**	UU9	**$1.00**
6AN7	**$1.25**	6BL8	**$1.00**
6N8	**$1.25**	12BE6	**$1.00**
6BM8	**$1.50**	6BD7	**$1.00**
1S5	**$1.00**	6AU4	**$1.00**
1T4	**.50**		



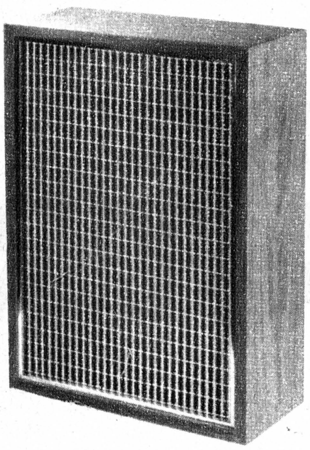
TV. IF video and sound strips .. **$10**
With Valves **$15**



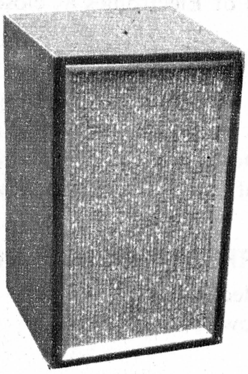
TV IF Coils, ideal for Coil Formers
.... **$1** dozen.



SPEAKER BOX for 6 x 9 or 7 x 5, **$5.00.** Speaker, **$4.00 extra.**



SPEAKER BOX SLIMLINE, 19 x 13 x 6 .... **$15.00**
8in bass speaker, 3in tweeter.
Without speakers.



MULLARD BOOKSHELF "MINI" SPEAKER CABINET. 6in 6WR. 3TC speakers **$25.00**

TWO-GANG TUNING CONDENSER. Stromberg Carlson **50c**

TV Chassis. Famous make, new
half complete **$8**
Pack and post **$1.75**

Dial drums 5 inch, 3½, 3⅞ .. **50c each**

National speakers 8 inch built-in Tweeter, Cross over net work. **$15**
10 inch Bass, mid range Tweeter combined. **$32**

Magnavox GWR, 8 WR, 10 WR, 12 WR. Tweeter 3, 4 or 5 inch

Speaker Plugs, 4 pin .. .. **15 cents**
Speaker Sockets .. .. **15 cents**

TUDOR RADIO

L. E. CHAPMAN

Established 1940

103 ENMORE ROAD,
ENMORE, N.S.W.
PHONE: 51-1011

Sorry no C.O.D.

Pack and post for all goods

SHORTWAVE AND BROADCAST SWITCH BANKS .... **$2.50** each
Pack and post, 20c.

SPECIALS

TRANSISTOR AUDIO TRANSFORMERS, medium size .. **75c** each

PHILIPS GRAMOPHONE MOTOR. 4-speed. New. 6-volt **$5.00**
Pack and post, 10c.

TRANSISTOR OUTPUT AND DRIVE TRANSFORMERS. Medium size, **$1.50** pair.
Pack and post, 10c.

SPEAKER TRANSFORMERS, 5,000 to 8 ohms 10 watt .... **$1.90** each
Pack and post, 20c.

Large Ferrite Rods and Coils .. **$1.50**

DYNAMIC MICROPHONES, good quality **$7.50**

8-STRAND WIRE ONE SHIELDER, **20c** per yard.

CARAVAN TV AERIALS .. **$10.50**

SILICON DIODES 210 3254G HR15, **75c** each

CAR RADIOS, new push-button transistor 8 .... **$50.00**
Pack and post, **50c.**

TV IF STRIP, WELL-KNOWN MAKE, printed circuit video and sound, complete except valves **$15.00**

CABINET CLOTH, best quality, **50c** sq. ft.

SPEAKER 4in 27 ohm, 47 ohm **$2.00** each.
Pack and post, 20c.

TV CABINETS, 19 SLIMLINE, with screw-on legs. Brand-new and polished maple, packed in original cartons. Ideal for speaker enclosures, etc. **$10.00**

ELECTROLYTIC CAPACITORS, 20, 400, 450, 10, 400, 450 .... **$1.50**
50, 65 .... **50c each**
Pack and post, 10c.
500, 10VW, 12VP **30c**
400 MFD, 10V **30c**
00.5MFD, 2000 DD.CW HERMSCEAL, **20c**

TRANSISTOR TUNER AND AMPLIFIER, well-known make **$15.00**
Tested. In perfect working order.
Pack and post, 20c.

TRANSISTOR SPEAKER TRANSFORMERS, 500 to 30 ohm **50c**
Pack and post, 10c.

TRANSISTOR CHOKES, 2 ohm **50c**
Pack and post, 10c.

NEW RADIOGRAM, chassis, mono, complete, valves, speaker **$13.50**

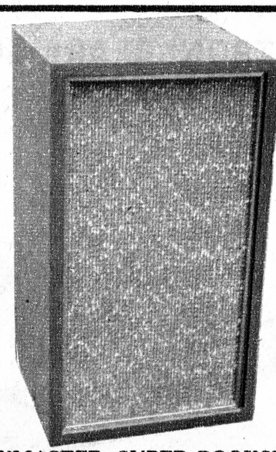
GARRARD, 32 volt, 3 speed record changer **$15**

DE LUXE RECORD CHANGER CASES, perspex. TOP **$19**
Pack and Post **$1.**

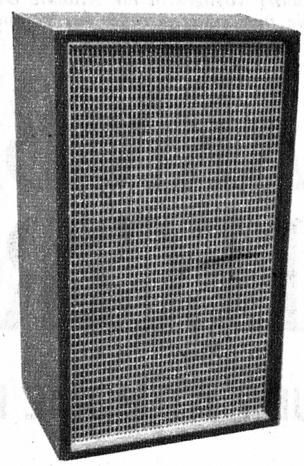
Garrard tape deck Cartridge, battery operated **$20**

Goldring Cygnet de luxe, 4-speed battery record player, Auto. stop. **$17**

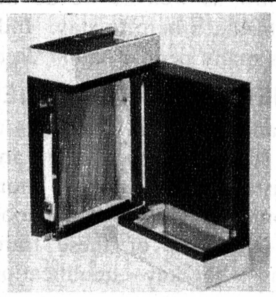
Sangamo time motor units. 1/3 Revs. 1 Hour **$4**



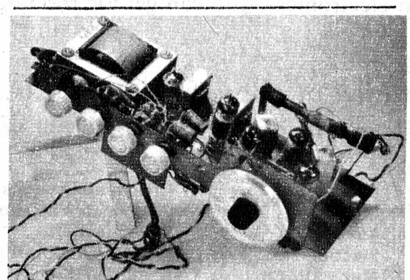
PLAYMASTER, SUPER BOOKSHELF. Two 6WR, one 3TC speakers .. **$37.00**



26 x 17½ x 10½ 8in **BASS SPEAKERS.** 5in tweeter. Crossover networks, **$37.00**



INSTRUMENT CASE, suit record player, etc. .... **$7.00 each**
Pack and post, 50c.



STEREOGRAM CHASSIS VALVES. Complete except speakers **$25.00**
Pack and post, $1.50.

Lenco Swiss gramophone motor and pick up. Auto stop. De luxe **$17**

Dial scales, 5in 11½ x 6, 10½, 3½, 9¾ x ⅜ **50c**

TECHNICAL BOOKS AND PUBLICATIONS

Pulse Generators — New Edition

PULSE GENERATORS, edited by G. N. Glasoe and J. V. Lebacqz. Published by Dover Publications, Inc., New York. Soft covers, 5-3/8in x 8½in, 741 pp., many circuits and diagrams. Price in Australia $3.75.

This volume is a Dover republication, unabridged and unaltered, of the work first published in 1948 by McGraw-Hill as volume 5 of their now-classic "M.I.T. Radiation Laboratory Series." It may be remembered that the latter series was the outcome of much of the development work carried on at the Massachusetts Institute of Technology Radiation Laboratory during World War II, and has long been recognised as one of the most distinguished and comprehensive series ever published on radio engineering.

As its title suggests this volume deals with pulse generation, shaping and transformation; and as one might expect it is orientated mainly towards magnetron tubes and radar applications. However, the theoretical treatment is sufficiently general in most sections to be applied quite easily to more modern devices and applications. The book is therefore far from being worthy only of historical interest. Rather it probably deserves a place on the reference shelf of most engineers and physicists working in the pulse field.

The chapter headings give a fairly clear idea of the material given and its order of treatment: 1 — Introduction; 2 — The Output Circuit of a Hard-Tube Pulser; 3 — Vacuum Tubes as Switches; 4 — Driver Circuits; 5 — Particular Applications; 6 — The Pulse-Forming Network; 7 — The Discharging Circuit of the Line-Type Pulser; 8 — Switches for Line-Type Pulsers; 9 — The Charging Circuit of the Line-Type Pulser; 10 — Performance of Line-Type Pulsers; 11 — Particular Applications; 12 — Elementary Theory of Pulse Transformers; 13 — Pulse Transformer Design; 14 — Effect of Pulse Transformer Parameters on Circuit Behaviour; 15—Materials and their Uses in Design.

The treatment throughout is at engineering level, and assumes a fairly solid mathematical background. However the text is well written and although concise is quite readable. Bibliography is distributed through the book as footnotes. There are two appendices, one dealing with oscilloscopic and other measuring techniques and the other giving a discussion of the concepts of duration and amplitude as pulse parameters. The book ends with a list of symbols and an index.

To summarise, **Pulse Generators** seems a worthwhile republication of the book which might still be regarded as the classic work in this field.

Our copy came from the Australian distributors for Dover, who are Grenville Publishing Company Pty. Ltd. However we understand that copies are already available from the major bookstores. (J.R.)

Laboratory Instrument Practice

ELECTRONIC LABORATORY INSTRUMENT PRACTICE, by T. D. Towers, M.B.E., A.M.I.E.E., A.M.I.E.R.E. Published by Iliffe Books Ltd., London. Advance proof copy. 164 pages 8½ x 5½in.

In compiling this book, the author professedly has had three potential reader groups in mind: (1) Advanced amateurs and technicians who need to be "filled in" regarding instruments commonly found in electronic laboratories; (2) Graduates who may be strong in basic theory but unfamiliar with practical test equipment and (3) Executives and administrators who have been away from the bench long enough to get out of touch.

Systematically, he talks about the instruments and methods encountered in everyday laboratory practice, with basic circuits to indicate principles and pictures to illustrate typical instruments. Due attention is paid to orders of accuracy, both inherent in the various class of instrument, and as affected by connection of the equipment to the circuit under test.

Following a preliminary discussion the chapters deal with the following subjects: (2) Direct current and voltage measurements; (3) Signal generators, audio, RF and pulse; (4) Alternating current and voltage measurements; (5) Measurement of resistance; (6) Impedance, capacitance and inductance; (7) Oscilloscopes; (8) Measurement of power and gain; (9) Audio amplifier measurements; (10) Measurement of frequency; (11) Transistor testing; (12) Bench power supplies.

While the text is right up to date, including due reference to digital instruments, it is highly readable and confined to instruments and techniques which are familiar in most laboratory situations. The author does not become involved in special-purpose instruments or techniques, as might be needed for research or process control.

Examination of the contents and sample reading indicated a practical and lucid approach, which could be most helpful to the classes of reader whom the writer has had expressly in mind. (The copy examined was a proof edition made available by the Technical Book and Magazine Company Pty. Ltd., of 289-299 Swanston St, Melbourne. They advise that properly bound copies will be available shortly for $5.80 (plus postage.)(W.N.W.)

Digital Computers

BASICS OF DIGITAL COMPUTERS, by John S. Murphy. Published by John F. Rider Publisher, Inc., New York, 1958. Seventh Printing, 1966. Four volumes, 6in x 9in, in soft covers, approx. 135pp. per volume. Many circuits and diagrams. Price in Australia $8.78 complete.

Although this book is substantially unchanged since it was written in 1958, much of the material which it presents is far from being outdated in 1967. In fact, from the point of view of content the book is probably of almost as much value now as it was originally. Yet despite this I can't really commend it as a worthy "first introduction" to digital computers, and for the same reason which would have stopped me from doing so when it was first published: its presentation just isn't good enough.

Part of the problem seems to be that the author has relied too heavily on a "picture-book" approach, and has simply not provided enough solid explanation as written text. A picture may indeed be worth a great many words, yet pictures alone—or almost so—are hardly adequate for effective communication of abstract and complex technical concepts.

But it seems to me that the main cause of the poor presentation is that there has been confusion as to the class of reader for which the book has been written. This has resulted in a rather strange conglomeration of electronic and logical concepts at not one, but a number of stages of specialisation and elaboration. Perhaps the idea was to provide something for everybody; yet the result would appear to this reviewer to be of dubious value to anyone.

In his preface, the author states that the book was developed for the training of **computer technicians** and **field engineers.** Even allowing for what one might genially term the "broadness" of American usage of these titles, one is surely justified in assuming from this that the intended reader will necessarily have at least a basic knowledge of electronics. Yet in volume 2, following on the heels of a section explaining the operation of the univibrator or "one-shot," we find a whole section devoted to an explanation of germanium diode operation at the most elementary level. This was apparently thought necessary as introductory material to a section dealing with diode damper and clamp circuits, just in case the would-be computer specialists didn't know what a diode was . . .

There are quite a few cases of this sort of thing. Another notable example is in volume 3 where the section on magnetic drum, disc and tape storage starts right

back at the level typified by "a magnetic recording head is an electromagnet shaped like a loop . . ."

Again, there are many diagrams which to my mind at least belong more in a kindergarten primer than in an introductory computer text. To illustrate something or other about the fact that a flip-flop stores both a binary digit and its complement, for example, we find a drawing of a cute little shopping basket with two eggs in it, accompanied by the caption "two eggs in one basket." And in the section dealing with timing and control—fairly advanced concepts, surely—there is a delightful little sketch of a lot of tiny cartoon hillbillies doing a barn dance, under a caption proclaiming "Standard timing is like a barn dance, where everyone finishes the dance with his original partner."

Finally, there are various places where either the text or the diagrams seem to me to be either inaccurate or ambiguous. Here are two examples. In volume 2, the most rigorous definition of an OR logic element I can find in the appropriate section is "an element which allows signals to pass from any one of a number of inputs to a common output, without allowing any interaction among the inputs." This definition has so much wrong with it that one hardly knows where to start; suffice perhaps to say that it is broad to the point of irrelevance, yet narrow to the extent that it completely excludes the widely used "wired-OR" function.

As a second example, in the same volume there is a diagram showing four thermionic valves silhouetted against a background of valve circuit symbols. The caption reads, "Vacuum tube envelopes and their schematic symbolisations." The block and its caption occupy a good half page, yet they seem both trite and irrelevant.

If you're seeking a basic introduction to computers and digital electronics, I'm afraid I can't advise that you consider this one.

Incidentally, our copy came direct from the Australian agents for Rider, who are Grenville Publishing Company Pty. Ltd. Copies should be already available from the major bookstores. (J.R.)

For Radio Amateurs

RADIO HANDBOOK, 17th edition, by William I. Orr, W6SAI. Published by Editors and Engineers Ltd., New Augusta, Indiana, U.S.A. Stiff, heavy, cloth cover, 847 pages, 9¼in x 6¼in, generously illustrated with line drawings, together with some tables and photographs. Price in Australia, $13, plus 35 cents postage.

The seventeenth edition of this already well known publication is still living up to its reputation. More particularly at technical level, it is a good book on general theory and, as such, it is an excellent reference work. The practical aspect of radio, leaning towards the construction of amateur radio equipment, is also given consideration. However, it does leave something to be desired in this field, as far as the keen home builder is concerned. This is possibly due to the fact that amateur equipment is so readily available in the United States and the urge to build one's own is not so great in that country. In spite of this comment, there are some excellent practical articles.

With a volume of this size, it would be a lengthy undertaking to review it completely. Unfortunately, the writer does not have immediate access to the sixteenth edition. However, the fourteenth edition is available and comparisons will be made against this one. This may not be unrealistic, as most readers would not purchase each edition of such a textbook and this comparison should be a worthwhile guide. Without going into great detail, here is a chapter comparison between the two volumes.

Chapters 1, 2, 3, 4, 6, 9 and 11 in the new volume are substantially the same as previously. Chapters under the headings:—Frequency Modulation (Ch. 13), Transmitter Design (Ch. 17), High-Frequency Directive Antennas (Ch. 22), VHF and UHF Antennas (Ch. 23), Workshop Practice (Ch. 32), and Radio Mathematics and Calculations Ch. 33), are also substantially the same, except that the chapter numbers have been changed.

Chapters headed:— Amplitude Modulation (Ch. 13), Television and Broadcast Interference (Ch. 18), Radiation, Propagation, and Transmission Lines (Ch. 20), Antennas and Antenna Matching (Ch. 21), and Rotary Beams (Ch. 24), have had some material added, either to enlarge on subject treatment or to bring the chapter up to date.

Chapter 5, Transistors and Semiconductors, has been up-dated and includes material on field effect transistors.

Chapter 7 has some new material covering linear amplifiers and intermodulation distortion.

Chapter 8 discusses the use of the oscilloscope for SSB measurements.

Chapter 10 includes information on Q multipliers and product detectors.

Chapter 12 is new, with subject matter on RF Feedback.

Chapter 15 has been added and is devoted to Radio Teletype Systems.

Chapter 16, Sideband Transmission, has been brought up to date and contains much useful information.

Chapter 19, Transmitter Keying and Control, has material added on differential keying and vox circuitry.

Chapter 27, Low-Power Transmitters and Exciters, is an added chapter and is made up of a number of constructional projects.

Ch. 25, Mobile Equipment Design and Installation; Ch. 26, not named, deals with the construction of receiving equipment; Ch. 28, High Frequency Power Amplifiers; Ch. 29, Speech and Amplitude-Modulation Equipment; Ch. 30, Power Supplies; Ch. 31, Electronic Test Equipment. All these have in varying degrees, been revised or rewritten.

This volume, from an appearance point of view, is at first sight very attractive, having a white binding. Unfortunately, as is evidenced in our review copy, the white binding is showing signs of soiling already. However, this could be avoided with a plastic protective cover.

To sum up, if you do not already have this or a recent edition, it is well worth a place on any engineer's, technician's, or radio amateur's bookshelf.

Our copy came from the Technical Book and Magazine Company Pty. Ltd. of 289-299 Swanston Street, Melbourne. (I.L.P.)

"Novice" Stations

BUILDING YOUR AMATEUR RADIO NOVICE STATION, by Howard S. Pyle, W7OE. Originally published in U.S.A. by Howard W. Sams and Co. Inc. This edition is published and distributed by W. Foulsham and Co. Ltd., Slough, Bucks., England. It has an introductory chapter printed in Great Britain, with the balance printed in U.S.A. Hard covers, with 103pp, 11in x 8½in. Well illustrated with many pictures and drawings. Price in Australia is $4.75.

As the title implies, this book was intended originally for the American Novice Amateur. An introductory chapter has been added for the benefit of readers in Great Britain. This brings out certain points relating to the availability of components and different practices between the two countries. Although the Australian requirtments are different again in some respects, the chapter is valuable in that it alerts the reader to watch for possible problems.

The book is quite well written and each aspect covered is given in so much detail that it should be possible for the absolute beginner to follow all instructions and explanations. This is taken to the point where there are several pages in the back of the book which include templates to assist in the construction of some of the projects described. With this all in mind, this could be an excellent book for one starting out even as a short-wave listener, who wished to build his own first receiver.

Chapter 1, called Initial Considerations, deals with such items as tools, soldering, quality and standard of workmanship, along with various hints and tips on how to go about construction work.

Chapters 2 to 6 are devoted to the construction of a simple but well thought-out multi-band short-wave receiver. As the number of chapters would indicate, the amount of detail devoted to this little receiver, could scarcely be enlarged upon.

Chapters 7 and 8 are devoted to constructional details of a simple multi-band transmitter. This transmitter is crystal controlled and uses a 6DQ6B valve and it is intended for CW mode only. The same comments as the receiver also apply here.

To give an idea of the contents of the rest of the book, here is a list of the other chapters:

Chapter 9—The Antenna System. Chapter 10—Station Accessories. Chapter 11—Speaker-Amplifier-Control Unit. Chapter 12—Arranging the Station. Chapter 13 — Future Construction Projects. Chapter 14—Looking Ahead.

To sum up, a very good book for raw, and not so raw beginners. The price is a little high but this is possibly due to the multiple printing costs. Our copy came from the Grenville Publishing Co. Pty. Ltd., 154 Clarence St, Sydney. Copies should be available from technical book shops. (I.L.P.)

G. A. Briggs writes on Hearing

ABOUT YOUR HEARING. Editor G. A. Briggs. Sub-Editor J. Moir M.I.E.E. Published by Rank Wharfedale Ltd., Bradford, England. First edition 1967. Stiff paper cover, 132 pages 8½ x 5½ inches, with many illustrations.

It is some time since we have reviewed a book carrying the name of G. A. Briggs and I was therefore not surprised when this new one turned up — his eighteenth — direct from the author's firm. I was somewhat surprised, however, by the title, for I had not thought of the Briggs' interest in ears going beyond their role as receptors for the sound from his highly commendable — and highly commercial — line of Wharfedale loudspeakers. However, it seems that friend Briggs has been thinking about ears hard enough and long enough for him to want to write about them.

In so doing, he lays no claim to having created a book of either medical or engineering significance. His aim has been to write in a fashion which will interest and educate those of us who regard ears as organs which can help support spectacles, need washing at regular intervals, ache occasionally and, more particularly, become less efficient with the passing years. And this last appears to be the main focus of the book.

The author begins by talking about ear trumpets and aids of another century, the resonance of seashells and so on. He then goes on to sound and hearing generally, with a chapter on the ear itself. Succeeding chapters deal with deafness, tests for loss of acuity, modern hearing aids, and some of the surgical resource that is now available to the incapacitated.

Inevitably there is a chapter on noise which, among other things, warns young people about the hazard of excessively loud music in pop-group situations, plus another chapter on sound reproduction, mainly involving headphones.

According to the preface, the material in the book has been carefully checked by experts in the various subjects and at least four chapters have been contributed by outside authors. The stamp of G. A. Briggs is firmly upon the book, however, in the way of interspersed quotations, humorous remarks and cartoons. As I said before, this is not a textbook but it is nevertheless a book that should prove entertaining and instructive to anyone whose interest has been quickened, for any reason, in those convolute receptors on either side of his head. Our copy came from the publishers but supplies should be available in due course through regular technical booksellers. (W.N.W.)

* * *

ABC's OF CAPACITORS, by William F. Mullin. Originally published in the U.S.A. by Foulsham-Sams Technical Books. This edition published in the U.K. by W. Foulsham and Co. Ltd. with an introduction for the English reader by W. Oliver. Hard covers, 5½in x 8¾in, 96pp. Price in Australia, $3.40.

This book has been written primarily for the serviceman. While it includes essential theory, it is more concerned with the operation and use of capacitors, and their replacement in circuits. The added introduction points out the differences between American and English circuit symbols, and also warns against relying on the colour code set out in the book because of the differing standards.

The contents of the book are: What is a Capacitor? — this chapter includes definitions and explains basic construction and units; Capacitor Theory — including dielectrics, losses, time constant and reactance; Capacitor Construction — the construction with dielectrics of air, mica, glass, paper, plastic-film (polyester, polystyrene and polycarbonate), and ceramic, and of aluminium and tantalum electrolytic capacitors; Capacitor Applications — giving some of the possible uses of capacitors in circuits; Capacitor Replacement — considerations when replacing faulty components; Capacitor Testing—simple tests to check suspected capacitors.

Within its rather narrow field, this book is quite sound and should be of assistance to the up and coming serviceman and student technician.

Our review copy was supplied by Grenville Publishing Co. Pty. Ltd., 154 Clarence Street, Sydney. Copies should be obtainable from leading book sellers. (J.H.)

* * *

DICTIONARY OF RADIO AND TELEVISION, by W. E. Pannett. Published by George Newnes Ltd. Tower House, Southhampton Street, London W.C.2. Hard covers, 5in x 7¼in, 373pp. Price in Australia, $5.90.

This book has a wider scope than is indicated by its modest title "Dictionary" and by the words "Radio and Television." The definitions, in some cases, are quite extensive and include some on telecommunications, semiconductor and thermionic devices, audio engineering, radio navigation and radio astronomy. Elementary principles and circuits are described briefly, but more complex and newer devices are covered in greater detail, where necessary, to

make the principle or mode of operation clearer.

To supplement the definitions, a number of useful appendices is included at the end of the book. The subjects covered by these appendices are: symbols for units with abbreviated prefixes; classification of radio waves; frequency-wavelength conversion; semiconductor symbols; abbreviations; colour codes; and, circuit symbols.

This book should prove of value to technical personnel engaged in one field of electronics who wish to check the definition of a term encountered in some other field. It will also be very useful to students and hobbyists, when confronted by an unfamiliar term or who wish to build up their background of knowledge by simply treating the book as a study text.

Our review copy was supplied by Hicks Smith and Sons Pty. Ltd., 301 Kent Street, Sydney, who have copies available from stock. (J.H.)

★ ★ ★

TV FAULT FINDING, Data Book Series No. 5. Edited and revised by J. R. Davies. Published by Data Publications Ltd., 57 Maida Vale, London, W.9. Stiff paper covers, 8½ x 5½in, 124 pp, numerous illustrations. Price in U.K. 8/6.

It is obvious that a book with a mere 124 small format pages can lay no claim to being a comprehensive work on TV servicing, and the editor acknowledges this fact in a short introduction. He says he assumes the reader to have already a basic knowledge of TV theory and practice, and in view of this the early part of the text, which is an elementary discussion of TV standards, seems rather unnecessary. From there on the book contains a considerable amount of useful data on faults which commonly develop, the visual and/or audible symptoms, and the causes and cures. The text is clearly and concisely written, and is illustrated with numerous diagrams and photographs of fault symptoms seen on the picture tube.

The value to the Australian reader is diminished by the necessity to cover both the 405 and 625 line standards now used in U.K. but the greater part of the text is applicable to both systems.

Chapters are entitled: The RF Stages — Receiver Alignment — Interference — AGC Circuits — TV Aerials — The Timebases — Power Supplies — Cathode Ray Tubes. There are two appendices entitled Transmission Frequencies and Fault Finding Guide. The former has no interest for the Australian reader, as it lists the channel freqencies used in U.K., which differ from those in use here. The latter is a tabulation of 50 common faults, listing symptoms, probable causes, and the relevent section(s) of the text.

While there are obviously many better books dealing with this subject, this modest work could well find a place in the bookshelf of the person who is not himself an electronics engineer but likes to do his own servicing, and the modest price in U.K. leads one to believe that it is likely to sell here for well under $2. The review copy came direct from the publishers, and we have no information on availability or selling price in Australia. No doubt the larger booksellers will be in a position to supply in due course. (H.A.T.)

LITERATURE—in brief

MINIWATT DIGEST, Vol. 6, No. 7 (May 1967), features a single article entitled "An experimental alphanumeric store and display unit using an electromagnetic cathode-ray tube." The display system enables digitally encoded characters, stored in four registers, to be displayed as dot-delineated patterns on the screen of a conventional 11in TV picture tube. The circuitry for achieving the storage, transfer and the inputting of new information makes up the larger part of the system. This is described after a discussion on the methods of character display.

Miniwatt Digest is published by the Miniwatt Electronics Division of Philips Electrical Pty. Ltd., 20 Herbert Street, Artarmon, N.S.W. Subscription rates are $3 post free per volume, and 50c post free for a single copy.

TELECOMMUNICATION JOURNAL, Vol. 34, No. 5 (May, 1967), the monthly review of the International Telecommunication Union (ITU), features an article by J. Uecker on the telephone exchange of the ITU; and a study by A. Kachel on "Compatible single-sideband transmission for amplitude-modulation sound-broadcasting services." Some information is given on the SEACOM Pacific submarine cable and on "Telecommunications in modern meterology." The series describing ITU conferences continues with the International Telegraph Conference held in Vienna, 1868, and the International Telegraph Conference held in Rome, 1871-1872.

Telecommunication Journal is published in separate editions in English, French and Spanish. Subscription rates are: one language, 20 Swiss francs a year; two languages, 30 Swiss francs a year; three languages, 40 Swiss francs a year. Price for single copies is 2 Swiss francs. The journal can be obtained from the Publications Service of the International Telecommunication Union, Place des Nations, 1211 Geneve 20, Switzerland.

MINIWATT ELECTRONICS DIVISION has published short-form catalogues listing semiconductors and valves. The semiconductor catalogue gives essential characteristics and outlines of available types including silicon and germanium transistors, integrated circuits, zener diodes, silicon power diodes, silicon controlled rectifiers, microwave mixer diodes and tunnel diodes.

The valve catalogue lists characteristics and base connections of valves and picture tubes for TV receivers, audio applications and mains-operated radio receivers. Inquiries to: Philips Electrical Pty. Ltd., 20 Herbert Street, Artarmon, N.S.W.

BELLING AND LEE (AUSTRALIA) PTY. LTD. has published its 1967 electronic components catalogue. This gives essential details of a wide range of components, including screened and unscreened plugs and sockets, terminals, and circuit protection devices. A miscellaneous section includes TV accessories, interference filters, and lists overseas agencies held by Belling and Lee. A trade price list is also available. Inquiries to the head office at Canterbury Road, Kilsyth, Vic., or to 170 Burwood Road, Burwood, N.S.W.

STC COMPONENTS REVIEW, Vol. 4, No. 6 (June, 1967) includes information on the following products: types 24 and 25 relays; thermistors; Lorenz hi-fi loudspeakers; VHF power transistor summary; data on 2N3553 VHF-UHF power transistor. The application note describing VHF-UHF power transistor amplifier design is continued. Inquiries to Standard Telephones and Cables Pty. Ltd., Moorebank Avenue, Liverpool, N.S.W.

TECHNICAL NEWS BULLETIN, Vol. 51, No. 5 (May, 1967), published in the U.S.A. by National Bureau of Standards, includes the following articles: NBS Develops Computerised Industry Model; Ad Hoc Cryogenic Committee Formed; Frequency Range of Calibration Vibrators Extended; Thermal Convection During Crystal Growth; Shock Tube Produces Controlled Pyrolysis. Subscription rate for the publication is $US2.25. Inquiries to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402, U.S.A.

RADIOTRONICS, Vol. 32, No. 1 (February, 1967), published quarterly by the Amalgamated Wireless Valve Co. Pty. Ltd., features the following articles: Second breakdown effects of transistor applications; Design trade-offs for RF transistor power amplifiers; Practical and usable methods for evaluating thermal runaway in transistor audio output stages. Also included is infor-

mation on new products: bi-planar image tube RCA-C33012A, and beam power tube RCA-Dev. No. A2814. Radiotronics is available at a cost of 50c per copy from the Sales Department, Amalgamated Wireless Valve Co. Pty. Ltd., Private Mail Bag, Ermington, N.S.W.

PROCEEDINGS of the 1967 National Association of Broadcasters Engineering Conference held April 3-5, 1967 will be available from the publishers, TAB Books, 18 Frederick Road, Thurmont, Md. 21788, U.S.A., from August 30, 1967. The volume includes the 23 technical papers presented at the conference, plus a transcript of the Government/Industry Panel discussion. The "Proceedings" has 224 pages, 8½in x 11in and is comb-bound for convenient use. The special prepublication price, $US7.95, applies until September 30, 1967; after that date the regular list price is $US10.

MANUFACTURERS SPECIAL PRODUCTS PTY. LTD. has available a leaflet giving advance information on the MSP speaker type 12UA designed especially for guitar amplifiers. This speaker is claimed to represent a breakthrough in design for this application. Other leaflets which can be obtained from MSP describe the following products: Hi-Flux standard speakers; 8TAX Hi-Flux twin-cone speaker; car radio replacement speakers; MSP shelf enclosure design; MSP column enclosure design; Hi-Flux hi-fi vented enclosure. Inquiries to the manufacturers at 47 York Street, Sydney, N.S.W.

STANDARDS ASSOCIATION OF AUSTRALIA has issued two Australian standard specifications laying down general performance characteristics and other requirements for sound level meters. The new standards, AS Z37 covering general purpose meters and AS Z38 covering precision meters, are virtually identical with recommended standards of the International Electrotechnical Commission.

The two standards describe instruments that provide a practical combination of characteristics aimed at achieving a high degree of stability and accuracy. Among specified characteristics are the frequency range to be covered, microphone sensitivity, accuracy of the indicating instrument, various effects on the amplifier, and calibration and sensitivity of the meter. Each standard sets out the information which must be given on the descriptive leaflet accompanying the sound level meter. Copies of AS Z37 and AS Z38 are available from the various offices of the Standards Association for 80c and $1 a copy respectively.

INTERNATIONAL TELECOMMUNICATION UNION has published the "General plan for the development of the international network in Asia and Oceania, 1965-1970." This plan was prepared at a meeting held in Melbourne from September 7-19, 1966. It is the work of the Joint Plan Committee for Asia and Oceania, one of four regional Plan Committees, of the International Telegraph and Telephone Consultative Committee (CCITT) and the International Radio Consultative Committee (CCIR).

The book of the Melbourne Plan, 1966, is published in a single three-language edition (English, French and Spanish). It comprises: tables of forecasts of international telephone, telegraph and telex traffic; maps of existing and planned international routes; maps of existing and planned earth stations for satellite telecommunications; forecasts of telephone, telegraph and telex circuits drawn up at the meeting, in particular for meteorology and civil aviation; the telephone and telex numbering plan for Asia and Oceania.

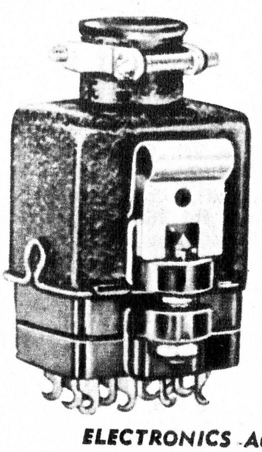
I.T.U. has also published "General plan for the development of the International Network in Africa," the last of the five volume series covering the whole globe. Inquiries should be addressed to the Sales Service, International Telecommunication Union, Place des Nations, 1211 Geneva 20, Switzerland.

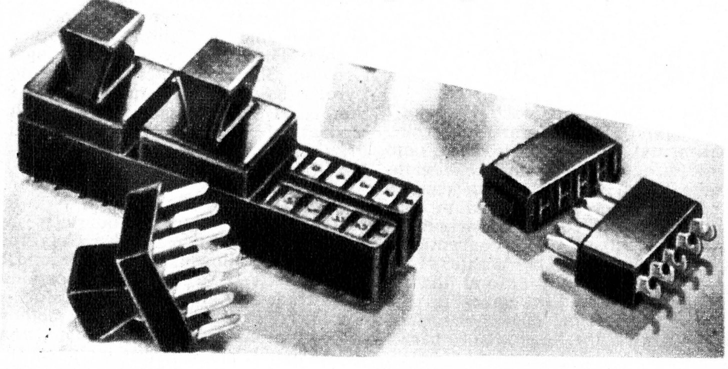
STANDARDS ASSOCIATION OF AUSTRALIA has issued an Australian standard AS Z46 setting out basic information on the metric system in its most recently developed form, the Systems International d'Unites (SI), and giving the names of the principal units.

The standard points out that the SI was adopted by the 11th General Conference on Weights and Measures in 1960, and that SI units have begun to replace older systems in several branches of science and technology. In addition to giving the names of units, the standard includes descriptive definitions of basic units and of derived units, e.g. force, energy. It also sets out values of some British units in terms of SI units. Copies of standard AS Z46 may be purchased at the various offices of the Standards Association for 60c each.

STC COMPONENTS REVIEW, Vol. 4. No. 5 (May, 1967) has information on the following: general purpose NPN silicon planar epitaxial transistors 2N2217-22; rectifier diodes EM400 series; interlocking plastic trays; Beyschlag deposited carbon film resistors; voltage variable capacitance diodes. Also included in this issue is a continuation of an application note on VHF/UHF power transistor amplifier design. Inquiries should be addressed to Standard Telephones and Cables Pty. Ltd., Moorebank Avenue, Liverpool, N.S.W.

TECHNICAL NEWS BULLETIN, Vol. 51, No. 4 (April, 1967), published by National Bureau of Standards in the U.S.A., includes the following articles: FOSDIC IV reads microfilmed weather data for computer; Chemical bonding gives stronger dentures; Data obtained for optical design; Research associate program expands; Photolysis of nitrogen compounds; Photodetector uniformity increased. Subscription rate for the publication is $US2.25. Inquiries should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402, U.S.A.





CREI TRAINING COURSES

"... of a high standard"

The Capitol Radio Engineering Institute, in Washington. D.C., U.S.A., was established in 1927 and it is now stepping up the promotion of courses in this country, as well as New Zealand. A short resume of the courses available and other aspects relating to the programs, are given below.

Like other systems of instruction, home study courses have been developed to a high standard and it is now possible to study successfully, a wide variety of subjects.

Courses for home study now make it possible for a student to take up a course of his choice, start a course at any time and proceed at a speed which fits in with his particular circumstances.

The Capitol Radio Engineering Institute offers home study programs dealing with a wide range of aspects of electronics. Each program is identified by a number and various programs are combined to form a course of study, to suit the needs of the individual student.

The Base Program 200—Electronic Engineering Technology—provides a comprehensive coverage of the theory and application of advanced electronics in relation to components, systems and devices. Because those who move ahead in any engineering organisation must possess qualities of leadership, Program 200 includes a series of assignments dealing with the principles of engineering management. These are interspersed with technical assignments. Program 200 is a basic foundation for the Major Elective which the student may choose and so lead to specialisation in one of the following fields.

Major Elective 300 — Communications engineering—deals with the fundamentals of communications and communications systems.

Major Elective 400—Aeronautical and Navigational Engineering. In this program, the principles of electronics are covered as they apply to systems currently used in navigation of military, airline and space vehicles.

Major Elective 500—Television Engineering—covers the principles and design of transmission and receiving equipment, including colour television.

Major Elective 600—Servomechanism and Computer Engineering — is recommended for those seeking specialisation in automation, radar and navigational control systems.

Major Elective 700 — Nuclear Instrumentation and Control. Nuclear physics, reactor technology, heat and thermodynamics, automatic control and instrumentation are the study areas covered here.

Major Elective 1100 — Aerospace Radar Engineering — deals with the applications of radar in aerospace, in both air surveillance and air traffic control.

Major Elective 1200 — Space Data Systems — covers data acquisition, processing and recording, analog and digital computers, computer design and components.

Major Elective 1300 — Spacecraft Tracking and Control — provides the student with an overall appreciation of space technology problems, such as the environment, orbit calculation and prediction, and with inertial guidance fundamentals.

Major Elective 1400 — Radar and Servo Engineering — is planned for men who wish to specialise in modern radar systems.

Major Elective 1500 — Communications Theory — covers such important areas of knowledge as information theory, microelectronics, modulation theory, Masers and Lasers, and infrared techniques.

One of the foregoing Major Electives, together with the Base Program 200, constitutes a complete Diploma Program in its own right. However, if the prospective student has had less than two years of practical experience with modern electronic equipment, or if he feels that he needs a review of arithmetic, algebra, etc., it may be necessary or desirable for him to take Program 100. This is an Introduction to Electronic Engineering Technology. Program 100 is not available separately.

Option M — Contemporary Mathematics —is designed to be combined with any Diploma Program and is recommended for students who wish to build upon the mathematics already studied in the basic program. It is not available separately.

In addition to the Diploma Program in Electronic Engineering Technology, just covered, there are three more Diploma Programs available.

Program 2000 — Nuclear Engineering Technology — covers the technical knowledge needed for a career in the application of nuclear power or in nuclear instrumentation. If necessary, Optional Program 100 may be taken as preparation for the main program. Program 2000 includes the series of assignments dealing with the Principles of Leadership.

Program 2500 goes into such subjects as: Introduction to Analog and Digital Computers, Data Processing, Logic, Logical Design, Analog to Digital Conversion, Problem-Solving Techniques, etc. Optional Program 100 may also be taken with Program 2500, which also includes the series of assignments on the Principles of Leadership.

Program 2600 has been developed to help men who work in electronics get the additional knowledge they need to move successfully into this field. This program covers such subjects as: Relays and Switches, Introduction to Thermodynamics, Applications of Light Energy, Ultrasonic Principles and Applications, etc. Program 2600 also includes the series on the Principles of Leadership and Optional Program 100 may also be taken.

Two Certificate Programs are also available separately. Program 2200 covers the Principles of Leadership. This program consists of 20 assignments and includes such subjects as: The Behaviour of Leaders, Leadership Through Communications, The Art of Interviewing, Counselling, Decision Making in Management, Creativity and Problem Solving, Leadership and Helping Others Grow, Scientific Management Concepts, etc.

Program 2300 is designed for students not enrolling for a Diploma Program. This Program treats such areas as: Differential and Integral Calculus, Determinants, Complex Variables, Fourier Transforms and Bessel Functions, Network Analysis and Synthesis, etc.

Finally, there are two Special Programs. Special Program 800 gives a broad coverage of electronics for qualified engineers who have not had previous experience in electronics. This program must include one of the Major Electives, which have already been listed as available with Program 200.

Special Program 900 is an up-dating program covering the modern developments in electronics, and is intended for engineers already qualified. Like special program 800, one of the Major Electives must also be taken.

At the completion of any C.R.E.I. Diploma Program, the student will qualify for his diploma if he has earned passing grades in all the assignment examinations. In addition, he must successfully complete a proctored comprehensive final examination covering his entire program. This rather stringent requirement adds real value to the C.R.E.I. Diploma.

The writer is well on the way through one of the diploma programs and this places him in a good position to evaluate the material which C.R.E.I. presents to its students.

All the program material is prepared by the staff of C.R.E.I. The level is very high and may be considered as "college level." With the exception of a book of mathematical tables, slide rule and valve data books, which are provided where necessary, all the material to be studied is included in durable, loose-leaf spring-back binders. Most binders contain seven assignments.

The printed material is well laid out, so the diagrams, tables, etc., are as near as possible to the relevant text. The fact that other texts do not have to be referred to, also makes study easier.

The texts are reviewed as often as is necessary and this ensures that the material presented is up-to-date. Such subjects as Basic Semiconductor Physics and various aspects of transistors, are kept abreast of the times.

As there are both good and not so good lecturers, so there are times when the printed page is not as well written as may be desired. Not surprisingly, the C.R.E.I. papers have their share of sections which might have been better phrased or ordered.

However, when a student gets into difficulties with an assignment, he has only to seek help from the C.R.E.I. staff and a prompt explanation is sent to the student, which sets matters right again.

Should a student have any comments or constructive criticism of any papers, this is welcomed by the C.R.E.I. management and staff.

Considering the study material overall, the writer is of the opinion that it is of a high standard, and has no hesitation in commending it to prospective students. These remarks apply in equal force to the assignments on the Principles of Leadership. These papers meet a great need for the guidance of people who are qualified in a particular field but do not have much idea of handling and guiding people in their charge.

Full details of all programs are given in well prepared catalogues. Readers who are interested may obtain full information, including fees for the various programs, by writing to the representative for Australia and New Zealand: C.R.E.I., Box E8, St. James P.O., Sydney, N.S.W. (I.L.P.)

Australis OSCAR A — Technical Details

The Australis amateur radio satellite is now in the U.S.A. for final testing prior to being launched into orbit

By Pierce Healy, VK2APQ*

After formally delivering the Australian amateur satellite, Australis OSCAR A, to the project OSCAR organisation, Richard Tonkin, Owen Mace and Paul Dunn, returned to Sydney en route to Melbourne on June 17th.

During their stay in the United States they had detailed discussions with the OSCAR personnel on the design and operation of the Australis satellite. They also discussed plans for a second Australis satellite designed to carry a repeater.

They all expressed their appreciation of the hospitality that was extended to them and the opportunity they had to inspect a number of Aerospace Companies and facilities to observe first hand the latest satellite techniques which will undoubtedly assist in later Australis projects.

They reported that the package arrived in perfect condition and to the great amusement of the Americans, as well as the Australians present, was found to be prominently labelled MADE IN AUSTRALIA and had a large sign reading "God Save the Queen." The satellite was thoroughly checked out in the OSCAR laboratory and found to be operating perfectly.

The design and construction of the satellite was highly praised by those who inspected the package. Some minor improvements in construction techniques will be considered prior to launching. If necessary, one or two back-up modules will be constructed and sent to the United States.

The technical details of the package have been supplied by Owen Mace, and appear on page 157.

REGION 1 NEWS

From the bulletin of Region 1 of the International Amateur Radio Union, received by courtesy of John Clarricoats G6CL, come several items of interest.

Concerned about possible attacks on amateur radio at future I.T.U. conferences and believing that many telecommunications authorities are not sufficiently familiar with amateur radio and its accomplishments, the American Radio Relay League two years ago contracted with the Stanford Research Institute to conduct an appraisal of the service.

This has now been done and, because the A.R.R.L. believes the report can be useful in explaining the importance and value of amateur radio to government officials around the world, two copies have been sent to each member society of the I.A.R.U. One copy is intended to be presented to the appropriate official in government telecommunications.

Although rather extensive, the importance of the report cannot be over-estimated. The title refers to amateur radio as "an international resource for technological, economic, and sociological development." It is considered that the Stanford report is of outstanding merit as a contribution to the literature of amateur radio.

ITALY

The new Italian amateur licensing regulations came into force on January 18, 1967. Most of the changes are favourable but one is retrograde. Additionally, two old problems remain unsolved.

On the credit side a simplified procedure for obtaining a licence has been introduced and the morse code examination has been reduced to 40 characters a minute for all three classes of licence. The age limit for obtaining a licence has been reduced from 18 years to 16 years, the validity of licences has been increased to five years and the input power allowed to holders of the 1st class licence has been increased from 50 to 75 watts.

When the need arises, amateur stations will be authorised by the Ministry of Posts and Telecommunications to handle emergency communications.

On the debit side operation on frequencies between 146MHz and 21GHz is no longer authorised but as the new Act gives the Ministry power to modify the allocation of frequencies it is hoped that a few channels in the 432MHz band will be allocated to Italian amateurs. The previous limitation of two narrow channels totalling 34KHz in the 3.5MHz-3.8MHz band is to continue.

To the great disappointment of many Italian amateurs the new regulations make no provision for mobile licences, neither do they permit a licence to be issued to a foreigner. However, a foreign amateur can obtain an operator's licence which authorises operation from the station of any licensed Italian amateur.

BELGIUM CONVENTION

The third Annual International Convention organised by the Knokke section of the U.B.A. with the support and in the name of the Belgium national society, will take place in the Casino, Knokke, on September 15, 16 and 17, 1967.

The trip to Knokke will be planned on the lines of an international amateur radio mobile rally, starting from London. Paris, Brussels, Amsterdam, Bonn, Geneva and other European cities. A competition for the "Grand Prix d'Honneur du Casino de Knokke" will take place on Saturday, September 16, followed on Sunday, September 17, by a VHF/UHF meeting under the chairmanship of R.S.G.B. council member Mr J. Foster, G2JF.

Several well-known amateurs will attend the meeting as guest lecturers. Further information on the convention can be obtained from Mr Lucien Vervarcke, ON4LV, Lippenslaan 284, Knokke 1, Belgium, who is secretary of the organising committee. Victor Claeys, ON4UM, is in charge of public relations.

MALTA

Among the overseas magazines that were received during the past month was a new one entitled "SIGMA," the official monthly bulletin of the National Radio Club, Malta. One thing in common with most other clubs and societies is the plea for members to take an active part in the work of running the organisation. Notice was given of the annual meeting, set down for Sunday, April 16, 1967, at 9.30 a.m.

The bulletin also carried an article giving helpful hints to S.W.L. members, on the art of QSL'ing, including an example report. The club is also preparing details for a DX competition.

For those wishing to contact the club, the address is: The National Radio Club, 35 St. Anthony Street, Balzan, Malta, G.C.

EUROPEAN FOX HUNTING

The president of the Central Radio Club of Czechoslovakia, Milos Svitak, is the chairman of a special committee set-up to organise the 1967 Fox Hunting championships which are expected to take place during the last week in September in an area about 50 miles south of Prague.

The championships will be organised by the C.R.C.C. in accordance with rules circulated, plus any minor modifications the international jury may decide upon prior to the start of the first event. Plans are being made by the organisers to provide all who attend the championships with the opportunity of visiting places of historic and cultural interest in Czechoslovakia as well as industrial centres in that country.

CYPRUS AMATEUR RADIO

The Cyprus amateur radio society have become a subscribing member of the Region 1 I.A.R.U. The society has 25 members, of whom 15 were licenced as at January 1st 1967. The president is Major Cyril Collins ZD4SC and the secretary is R. H. Etherington.

A single-class licence is available to those who can pass the necessary examination, including a 12 word per minute Morse Code test. The licence fee is equal to $A5.00 but a separate station licence is required, for which the initial fee is equal to $A6.00. Thereafter the annual fee is equal to $A3.00.

Maximum DC input power is 150 watts on all frequencies generally available to amateurs in Region 1. Amateur television is permitted but mobile operation requires special authorisation. Third party traffic is prohibited.

HERTZ or CYCLES

Standardisation on the use of the term Hertz (Hz) as the unit of frequency is not restricted to telecommunications. The I.T.U. General standardisation organisations, such as the International Electrotechnical Commission (I.E.C.) and the International Organisation for Standardisation (I.S.C.) have, in close liaison with the Commission for Symbols Units and Nomenclature (S.U.N. Commission) of the International Union of Pure and Applied Physics (I.U.-

***News and notes of Divisional and Club activities submitted for inclusion in these columns should be forwarded direct to Pierce Healy, 69 Taylor St., Bankstown, N.S.W.**

P.A.P.), decided to use the term Hertz. The decisions of the Conference General des Poids et des Mesures (C.G.P.M.) have thereby been followed completely.

For full information on all symbols, reference should be made to I.E.C. Publication 27, "Letter Symbols to be used in Electrical Technology" 1966 Edition, obtainable from the Central Bureau I.E.C., Geneva.

JAMBOREE-ON-THE-AIR

Since preparing the notes which appeared last month, on the Jamboree-on-the-Air, a copy of the report of the 1966 activities prepared by the Boy Scouts World Bureau, in Ottawa, Canada, has been received from Noel Lynch, Australian national organiser of J.O.T.A.

The report summarises the reports received from all over the world from scouting groups who participated in the event. It was very pleasing indeed to see mention made of the article that appeared in these notes in the October, 1966 issue and the inclusion among news cuttings from all over the world, used as a composite illustration on the cover, a full page of these notes.

In the general summing-up, the activities of the Australian scouting groups and amateur operators were highly praised and photos of a New South Wales and a Victorian were included in a selection of world-wide pictures. Several countries reported on special station call-signs allocated by the local communication authorities, for use during the Jamboree weekend.

Countries known to have taken part in the 1966 J.O.T.A., and, where known, the number of stations operating in each country were given. These were:

Algeria	1	Italy	1
Antigua	—	Jamaica	1
Argentina	9	Japan	8
Australia (including Papua and New Guinea)	450	Libya	—
Austria	80	Luxemburg	2
Belgium	1	Malta	3
Bermuda	—	Malaysia	2
Bolivia	3	Maldive Islands	—
Brazil	3	Mexico	26
Canada	400	Mozambique	7
Canary Islands	—	Netherlands	6
Ceylon	6	Netherlands Antilles	—
Chili	—	New Zealand	—
Columbia	58	Nicaragua	—
Costa Rica	—	Nigeria	5
Denmark	4	Norway	43
Dominican Rep.	—	Pakistan	—
Ecuador	2	Panama Republic	—
Finland	5	Paraguay	—
Fiji Islands	—	Peru	3
France	1	Philippines	—
Germany	10	Portugal	5
Ghana	1	Rhodesia	4
Great Britain	194	Salvador	2
Greece	1	South Africa	128
Guatemala	8	Singapore	1
Hong Kong	—	Spain	1
Iceland	1	Sudan	1
India	4	Sweden	12
Iran	—	Switzerland	5
Ireland	11	Trucial Oman	—
Israel	1	U.S.A.	1500
		Uruguay	7
		Venezuela	22

Despite the fact that the world-wide "CQ" DX Contest was held on the same weekend, thereby possibly reducing the number of stations that participated, the effect of this was far less than was expected.

A total of 453 scout groups and 59 girl guide companies were officially listed as having participated in Australia.

The success of any activity can only be judged by the information received in reports from participants. Therefore all participating groups are requested to send in reports on the J.O.T.A. weekend together with photos and press coverage of the event. Address them to Mr N. Lynch, Australian National Organiser, J.O.T.A., Boy Scouts Association, Box 50, P.O. Broadway, Brisbane, Queensland.

WIRELESS INSTITUTE ACTIVITIES

All six divisions of the Wireless Institute of Australia have ratified in full the recommendations of the Federal Council, made at the 21st Federal Convention, held in Hobart last Easter.

The most important subject recorded in the minutes of the convention relating to the overall administration of the institute, is the final agreement on several matters regarding the new federal constitution.

This agreement will now allow the federal executive to complete the work on the articles of association for the incorporation of the federal body under the Commonwealth Uniform Company's Act. While the full benefits of this move may not at first be apparent, it is considered to be an important step towards future expansion and facilities the Institute as a whole can offer the Australian amateur service.

The present W.I.A. federal constitution has been in operation since 1947 and although changes had been mooted for many years, it was not until 1962 that the matter was opened for formal discussion. The initial discussions highlighted many problems and weakness in the proposals submitted. This situation was further aggravated by the fact that Federal Council met only once each year and also by the varying numerical strength and assets of individual divisions.

In the final agreement, the rights and assets of all divisions will be protected by a collateral agreement between divisions and the federal body, appertaining to certain matters of finance and voting powers of each division.

It will probably be 1968 before all formalities are completed and a new era in the history of the Wireless Institute of Australia will begin. A point of interest is the fact that the W.I.A. is the oldest amateur radio organisation in the world, having been founded in 1910.

NEW SOUTH WALES

The May meeting of the New South Wales division drew the largest attendance of members for several years and could be referred to as a milestone in the activities of the division. A special meeting was called to consider the decision of council that a full time administrative secretary be employed. After many questions had been asked of the division's legal adviser and auditor, the meeting of more than 150 members voted unanimously in favour of the decision of council.

The discussions at the meeting also cleared up a contentious point in the thoughts of some members regarding the power of council to make such decisions, and put them into operation without referring their decisions to a general meeting. Under the constitution, council need only refer such matters as they think necessary for decision at a general meeting.

A unanimous vote of confidence in council was also passed by the meeting.

Subsequent to the meeting, council made the appointment and plans are being completed for the administrative secretary to take up duties and be at the Wireless Institute Centre, 14 Atchison Street, Crows Nest, during specified business hours.

Intending members and those interested in amateur radio will be able to visit the centre for information, while members will be able to avail themselves of the library facilities more readily. Other inovations for the benefit of members are under consideration of council. The appointment will considerably speed up and

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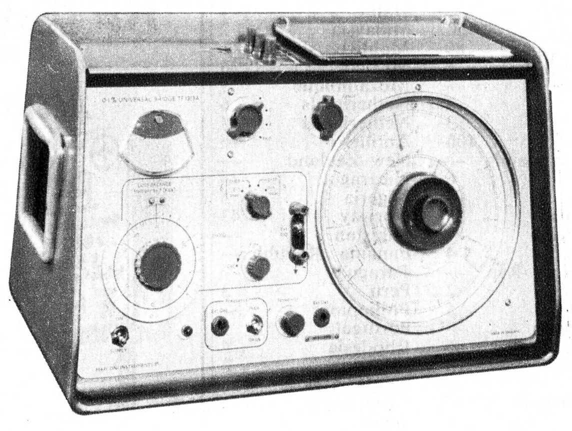

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improve the services to country members and interstate and overseas visitors.

At the general meeting that followed the special meeting, the minutes of the 1967 federal convention were presented for ratification by the Federal Councillor, Pierce Healy VK2APQ. After some discussion the motion was put and carried, there being only five dissenting.

Hunter Branch

There was a good attendance at the June meeting of the Hunter Branch to hear Tony Mullen, VK2ZCT, lecture on his five-transistor transmitter. The transmitter has been designed to fit on a printed circuit board 120mm by 70mm. The unit described is capable of an output of half a watt on the 144MHz band and used the popular 2N3564 transistor.

In addition to the transmitter the companion modulator was described and demonstrated, it being possible to power the complete unit from a dry battery source. By using modern techniques of printed circuit construction it has been possible in this design to reduce space taken to the absolute minimum and still retain a high degree of efficiency.

It is now the custom to screen films of technical interest at Hunter Branch meetings before the general business section. At the June meeting an interesting film "On Solder" was shown and proved to be a most interesting survey on this much neglected subject. The film is another in the series which depicts modern methods of electronic construction.

A full program of lectures and films has been arranged for branch meetings during the remainder of the year. In August there will be a film on valve manufacture to support a series of lecturettes by branch members.

Hunter Branch meetings are held in Room 6, Clegg Building, Newcastle Technical College, Tighes Hill, on the first Friday of every month excluding January. Visitors, whether Wireless Institute members or not) are always welcome.

Plans are well in hand for the Hunter Branch Field Day to be held on Sunday, October 15, at Bolton Point Park on Lake Macquarie. There will be a full day's program of transmitter hunts and competitions for both licensed amateurs and Youth Radio Scheme members. The charge for admission will this year include lunch. Full details of the event will be given in next month's notes.

WICEN Exercise

A full day's exercise of WICEN equipment was conducted early in June when five mobile stations took part in a simulated search operation in the area west of Newcastle. It was supposed that a party of scouts was lost in the rugged country of Mt Yango region near Wollombi and VHF carphones were used to advantage to relay messages from the search area back to the Central Control at Bolton Point.

Many useful lessons were learned from the exercise and it is hoped that a further operation of this type will be held as soon as the new aerial equipment is erected at the Westlakes Radio Club, Teralba. From field tests conducted, this appears to be the site from which VHF communications can be maintained over a large part of the Central Coast and Lower Hunter region. It is hoped to have a base station in operation from the Club within the next two months.

Central Coast Branch

The feature of the June meeting of the Central Coast Radio Club held on Friday 16, was a most interesting lecture by Mr Lyle Ronalds of Fairchild Aust. Pty. Ltd. Lyle, with the aid of a short film and a number of diagrams, outlined the "Planar process" used in the manufacture of silicon planar transistors.

The mass production of tiny wafers ten-thousandths of an inch square and four-thousandths of an inch thick, prompted many questions from those present. Despite very unpleasant weather, the meeting was very well attended. Visitors are always welcome to meetings of the Central Coast Branch which are held on the third Friday of each month in the School of Arts, Gosford, commencing at 8 p.m.

Weather Service for Small Ships

Sydney's Volunteer Coastal Patrol advise that they have instituted a special hourly weather service for small ships. The service consists of the current weather report as issued by the Weather Bureau, supplemented by a "weather observation" compiled from local weather conditions and reports from patrol boats and other craft in the area. Purpose of the broadcasts is to reduce emergencies caused by inexperienced boating enthusiasts who may not fully appreciate the possibility of sudden weather changes.

The reports are broadcast from the V.C.P. transmitter on the shores of Botany Bay, and are made at 15 minutes past the hour, during weekends and public holidays. Frequency of the channel is 4120KHz.

QUEENSLAND

SSB or AM? This question has been discussed in relation to the VK4WI news broadcast to members each Sunday morning, on the 7MHz band. Suggestions supporting both modes have been received by the divisional council. However, for a couple of years now 7MHz SSB has given an improved and reliable coverage and at the present time it is not practical to house privately a high-power AM station.

Following discussions at general meetings, and at the state convention at Alexandra Headland, council has decided to implement the motion passed at their June meeting—"that the W.I.A. news continue to be radiated from VK4WI on 7MHz SSB, 3.5MHz AM and if possible on 14MHz SSB.

Slow Morse Code practice sessions are conducted by the Queensland division every Tuesday and Thursday evenings between 7.30 p.m. and 8.15 p.m. on 3580KHz in the 80 metre amateur band.

WESTERN AUSTRALIA

The June issue of the VHF bulletin of the West Australian division has a very interesting article about improving receivers for weak signal reception. Several helpful suggestions are given and observation on the fact that even the best commercial type receivers use in general the same type of components as those available to the home constructor. Articles such as this are one of the benefits that membership of the group provides.

The group meets on the fourth Monday of each month in the D.C.A. workshop canteen, 86 Guildford Road, Maylands, Perth, at 8 p.m. Visitors are welcome.

RADIO SOCIETY OF EAST AFRICA

The Radio Society of East Africa, one of the oldest radio societies on the continent of Africa, is the official society for Kenya, Uganda and Tanzania. It has about 70 members of whom 30 held 5Z4, 3H3 and 5X5 calls as at January 1st 1967. The president is Major Roy Jarvis (retd), 5Z4IR, and the secretary Major D. S. Kent. The official address is P.O. Box 5681, Nairobi, Kenya, with branch offices in Dar-es-salaam, Tanganyika, P.O. Box 2387, and Kampala, Uganda, P.O. Box 3433.

A single-class licence is available to any one over the age of 14 years who can pass the necessary examination including a Morse Code test of 12 words per minute The licence fee is equal to $A8.50 but a separate licence is not required. All Region 1 bands are available from 3.5MHz to 144MHz with 1.8MHz also available on special application. Maximum DC power input is 150 watts. Maritime mobile operation is allowed with special authorisation but mobile operation and third party traffic are prohibited. The R.S.E.A. maintains an emergency corps.

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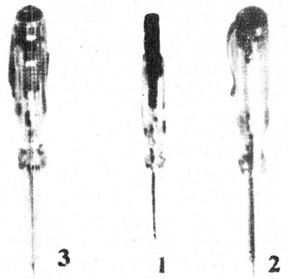

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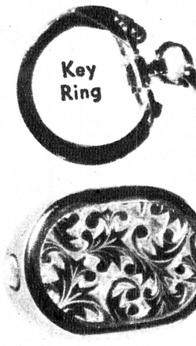

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DC Current: 0-.06-6-60-600 mA, 0-12 A.
Resistance: 0-60K-6M-60M (350, 35K, 350K at mid-scale).
Decibels: minus 20 to plus 57 dB (0 dB equals 1 mW. 600 ohms).
Audio Out: Capacitor in series with AC volt ranges.
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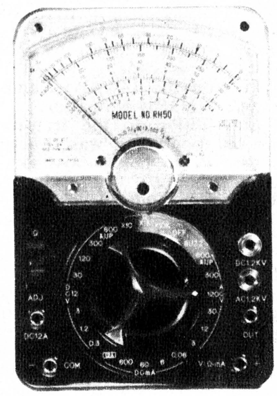
Accessory: 1 pr. heavy test leads.



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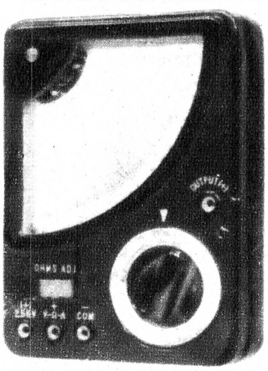

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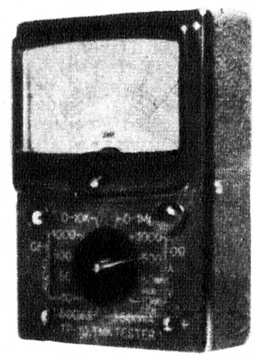
DC Current: 0-500uA 0-500 mA.
Resistance: 0-10K-1Meg: 60 ohms, 6K ohms at centre scale.
Capacitance: 250uuF to 1uF, in two ranges.
Decibels:—20 to plus 36db, two ranges.
Output; 0-1,000 V in four ranges.
Size: 5in x 3½in x 1½in.
Weight: 13oz approx.

Price $10.75 (£5/7/6)
Postage 50c to $1 extra.



TRANSISTOR HEARING AID

First Phone Model 3 Transistors

This Hearing Aid is an ultra-modern unit. It incorporates the following outstanding features:

Ample power and clear tone.
Compact,
Precision printed circuit design.
Magnetic earphone.
Separate Tone and Volume Controls.
Standard size torch cell.
Packed in a presentation case.

New Model $31.50

Replacement Battery only 12c.
Postage 50c extra.

Model RH-5

- High sensitivity-20,000 Ohms/V DC, 10,000 Ohms/V AC.
- 3in Meter.
- Handy pocketable size.

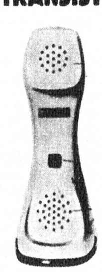
SPECIFICATIONS

DC Voltages: 0-10-50-250-500-1000 V (20,000 Ohms/V).
AC Voltages: 0-10-15-250-500-1000 V (10,000 Ohms/V).
DC Current: 0-50uA, 0-5-50-500mA.
Resistance: 0-10K, 0-100K, 0-1Meg, 0-10 Meg.
(62 Ohms, 620 Ohms, 6.2K, 62K at centre scale).
Capacitance: 0.0001uF-0.005uF, 0.05uF-1uF.
Decibels: minus 20db to plus 36db in 2 ranges.
Dimensions: (3½in x 5¼in x 1¾in).
Weight: 15oz approx.

Price $18 (£9/-/-)
Postage 50c to $1 extra.

Complete with internal battery, testing leads with prods.

TRANSISTOR POWERED TELEPHONE



$12.00 each

any number can be connected together.

Latest Stand type with Call Button on each unit.

Ideal for office or home installation.

WANTED

SALESMAN FOR OUR RADIO ELECTRICAL COUNTER

Enquiries phone 61-3832 or write to 306 PITT STREET, SYDNEY

W.I.A. YOUTH RADIO SCHEME

The Y.R.S. conference convened to discuss various aspects of the scheme, with the view of streamlining some facets and expanding the organisational structure, was held at Sydney Grammar School, Sydney, on Saturday afternoon, June 3, 1967.

The conference opened at 2.30 p.m., with 17 persons in attendance.

Present were: Mrs M. Swinton VK2AXS. Messrs: C. E. Whiting VK2ACD, I. M. Agar VK2AIM, J. Oosterveen VK2BJO, K. Howard, VK2AKX, D. A. Craig, K. J. Watson V2ZKW, D. Jeanes, VK2BSJ, J. W. Flynn, R. Davis, VK1RD, G. Hough, C. L. Matthews VK2BAI, J. Webster VK-2ZCW, D. J. Williamson, P. J. Healy VK2APQ, H. W. Rider VK3ZJY, Victorian Supervisor, M. E. Plummer, Secretary, Victorian Y.R.S.

Apologies were received from: H. Burtoft VK2AAH, T. Ivins VK2SS, Rev. Bro. Kinsella VK2AXK, J. Scougall.

In reviewing the aims and activities of the Youth Radio Scheme it was agreed that: "The Y.R.S. is an educational organisation of the Wireless Institute of Australia and its activity is to provide information, instruction and advice and to encourage and assist all persons interested in any or all aspects of amateur radio." It was also agreed that there would be no age limit for those wishing to participate.

When discussing the general administration of the scheme emphasis was placed on the work done by Rex Black, VK2YA (who is at present overseas). It was considered that the scheme had progressed to such an extent that an administrative body was now a necessity in New South Wales.

Nominations were called for and the following officers elected:

Secretary/Treasurer J. Flynn. Management Committee: D. Craig, D. Williamson, J. Webster. Ex officio member W.I.A. Liaison officer.

When discussing finance it was agreed that as far as possible the scheme should be self-supporting and to cover such expenses it was decided that a registration fee be set at $2.

Reviewing the examination papers and the certificates for the various standards provided quite a lengthy discussion and it was resolved that examination papers be standardised on a national level. This would be of a practical benefit to members moving from one State to another, as the requirements and syllabus would be uniform.

Mr K. Howard, VK2AKX, was directed by the conference to review in conjunction with the Victorian supervisor the academic level of the intermediate certificate paper and those of higher levels.

The subject of novice licences was discussed and following an explanation of the W.I.A. policy on the subject, by the chairman, the conference affirmed: "That this Y.R.S. Conference supports in full the W.I.A. Federal policy in regard to novice licences."

Mr H. W. Rider, Victorian supervisor, displayed a Y.R.S. lapel badge and a pocket badge. It was agreed that New South Wales would adopt the same badge, and it would be made available to those who had obtained their elementary certificate. The coat pocket badges would be available to holders of junior certificates.

Following the conference the Postal Group system has been modified to allow for better administration. In future this section will be known as "the Correspondence Section of the Youth Radio Club Scheme of Australia" and it will be administered by the Victorian division.

The office-bearers of this section are:—

Supervisor/secretary Roger Davis VK1RD
Treasurer Miss Alison Stewart.
Publicity officer David Jeanes VK2BSJ
Committee members Howard Rider VK3ZJY: Michael Plummer.

Inquiries regarding membership should be addressed to The Secretary, 14 Hovea Street, O'Connor, Canberra City, A.C.T.

The objectives of the Correspondence Section are:—

(a) To develop in young people an interest in radio and electronics as a vocation or as a hobby throughout life.

(b) To provide school students with a hobby activity which will reinforce their school activities in science and mathematics.

(c) To assist present and future group leaders of correspondence groups to instruct student members of such groups by providing ready made programs of activity.

(d) To co-ordinate the activities of all group leaders and to promote co-operation and interchange of ideas among group leaders.

(e) To give encouragement and recognition to members who attain certain specified standards of skill and knowledge in the field of radio by award of certificates.

(f) To provide all State divisions of the Youth Radio Scheme with facilities for an efficient correspondence program of study for those desiring to become members of the Y.R.S. but who are unable for some reason or another to join in their local Y.R.S. activity.

MAITLAND YMCA RADIO CLUB

Under the direction of Kev Watson, VK2ZKW, president and club leader, the Maitland YMCA Radio Club has made excellent progress since its formation last February. The room housing the library and canteen has been completed while the completion of the workshop will enable a start to be made on the construction of the club's electronic equipment. Members will also be able to start on projects of their own.

The club meets in its own rooms in the YMCA Building, 264 High Street, Maitland, N.S.W., every Friday night at 7.30 p.m., and also on Saturday afternoons at 2 p.m.

There is an active membership of 29, and a newsletter is published each month. The club is a member of the W.I.A. and the Youth Radio Scheme. Application has already been made for the allocation of a call sign for the club station.

Full details of the club activities can be obtained from the Secretary, P.O. Box 54, East Maitland, or telephone 33-7286.

Office-bearers are:—

President and club leader, Kev Watson VK2ZKW
Secretary, Margaret Watson
Librarian, Mathew Ingle
Advisory council, Bruce Whatson, Keith Ingle, Norm Blacktop, Bill Rimmer.

O.T.C. Presentation

On Friday, June 23, at the general meeting of the New South Wales division Mr Thatcher, of the Overseas Telecommunication Commission, presented the O.T.C. prize to a young Youth Radio Scheme member, David Frazer.

Of particular interest in Mr Thatcher's remarks was the point made regarding Y.R.S. training. The O.T.C. viewed favourably applicants for junior employment who had a substantial background of Y.R.S. training.

Youth Radio Scheme certificates carry with them the prestige of the Wireless Institute of Australia and as such are valuable qualifications for young job seekers in the electronics field. However, this is only one aspect of their value, for from the ranks of Y.R.S. today come the amateurs of tomorrow.

TECHNICAL DETAILS OF AUSTRALIS SATELLITE

Australis OSCAR A is a simple developmental satellite carrying two telemetry transmitters with seven data channels and one identification channel. The system has been tailored to suit the equipment available to most amateur radio operators and decoding instructions will be given later.

In order that experience may be gained in command techniques, a command receiver and decoder have been included to control the operation of the high frequency transmitter while the very high frequency transmitter remains continually running. The transmitters operate in the 10-metre and 2-metre amateur bands.

The command system controlling the high frequency transmitter is to be operated by a limited number of strategically placed Command Tracking Stations (CTS), and will not be available for general use. For that reason details of the system will not be published. A block diagram of the electronic systems aboard Australis is given in Fig. 1. A drawing of the package in orbit is given in Fig. 2.

Telemetry Encoder Unit: The Telemetry Encoder sequences the sampling of seven data channels and one identification channel. It encodes this information as an audio tone which is then fed to the two transmitters as modulation.

The master clock is an astable multivibrator with a period of about 7 seconds, and it is synchronised with the "HI" keyer. The sequencer is a set of three bistable multivibrators that successively divide the pulse repetition rate to once every 70 seconds. Each successive sensor is sequentially sampled by logic circuits. The sampled voltages are fed to a voltage controlled oscillator, the output of which is amplified and sent to a phase splitter. The two out-of-phase outputs are then used to modulate the two transmitters. The channel sequence and decoding details will be given later when describing tracking and decoding procedures.

The telemetry sequence consists of:

0. "HI" identification — two "HI's" in Morse (di-di-di-dit di-dit). These "HI's" will consist of an audio tone switched from about 400Hz to 1KHz for the space and mark periods respectively. The "HI's" are in synchronisation with the telemetry sequencer.
1. Battery current drain sensor.
2. X axis horizon sensor.
3. Battery voltage.
4. Y axis horizon sensor.
5. Battery temperature.
6. Z axis horizon sensor.
7. Inside skin temperature.

Each channel is maintained for 7½ seconds before switching to the next channel. It should be clearly understood that, unlike OSCARs I and II, the "HI's" carry no information and that any variation in their period is not necessarily an indication of the temperature in the satellite.

'HI' Keyer: This electronic switching unit provides the identification channel of the telemetry. The output is a voltage waveform with square pulses corresponding to the word HI in Morse Code and is produced by electronic oscillators and logic.

All circuits were designed to operate with transistors $\beta > 14$ and resistor tolerance $\pm 40\%$. The flip-flop ($\div 2$) was checked for tolerance by computer. All circuits were designed for low current drain and maximum reliability.

HF Transmitter: The HF transmitter is a ground commandable transmitter with a nominal output power of 250 milliwatts on 29.450MHz. It is switched on and off by signals received from ground stations via a command receiver and decoder. The transmitter carries the 8-channel telemetry, when on.

The power amplifier is a class C common-base circuit. This configuration was chosen for high efficiency and stability and to keep within transistor breakdown restraints. The transmitter is in fact switched on and off at an audio rate by the telemetry unit. The rise time has been softened to reduce high harmonic sidebands.

All stages are common base, and are double tuned between stages to reduce harmonic output. In fact, all spurious signals are at least 35dB below the fundamental carrier.

VHF Transmitter: The VHF transmitter has a nominal output of 50 milliwatts at 144.053MHz. It is continuously operating, functioning until the battery is exhausted, i.e. about two months. Telemetry modulates the transmitter in a manner similar to the HF transmitter and the comments which applied to that transmitter apply here.

Command Receiver: The command receiver detects commands transmitted to the satellite from ground stations. The detected audio is fed direct to the command decoder which decides whether a valid command has been sent and acts accordingly, to switch the HF transmitter on or off.

The command receiver is a double conversion superheterodyne receiver with detector and limiter to produce the audio output for the decoder. The receiver and decoder combination will reliably switch the HF transmitter with a signal to noise ratio of 10dB or a few microvolts received at the input.

Command Decoder: The purpose of this unit is to provide a gate voltage for the HF transmitter to bias the oscillator (and so the whole transmitter), on or off as required by ground stations. The decoder receives two audio tones from the receiver and determines whether these tones have correct pitch, length, spacing, etc. to constitute a valid command. When such a valid command is received, a flip-flop gate operates as required by the circuit. All circuits use either feedback or saturation to ensure that operation is independent of transistor characteristics and environment.

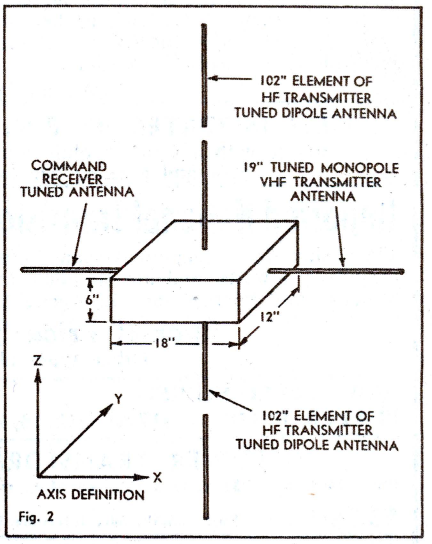


Fig. 2

Magnetic Attitude Stabilisation System: The magnetic attitude stabilisation system (MASS) consists of two seperate sections. The functions of these sections are detailed:

(a) Hysteresis Rods: These are special mu-metal rods with a very large hysteresis loop at the very low magnetic flux densities encountered in space. As the satellite rotates, the rods are cycled through their hysteresis loop and in doing so dissipate a small amount of rotational energy. Thus spin imparted at ejection into orbit is slowly reduced to a negligible value after one or two weeks. The horizon sensors will give a very good indication of the spin rate.

(b) Bar Magnet: Two small but very powerful magnets connected as a single bar magnet align the satellite with the Earth's magnetic field and thus give the satellite some degree of stabilisation. This should markedly reduce the fading of signals due to this rotation.

It should be pointed out, however, that theoretical predictions are notoriously unreliable, due to the uncertainties of eddy current losses and other factors.

Package: The package is a very strong assembly designed to withstand the stresses of launch. It has been made with the skin thermally insulated from the interior compartments containing the electronics modules and battery. This technique should maintain the inside at a more even temperature than would otherwise be possible.

The battery, being the most massive single item, is mounted in the centre with the electronics modules mounted on bulkheads attached to the battery pack. A diagram of the package is shown in Fig. 3. Note that the axis directions are defined for the horizon sensors.

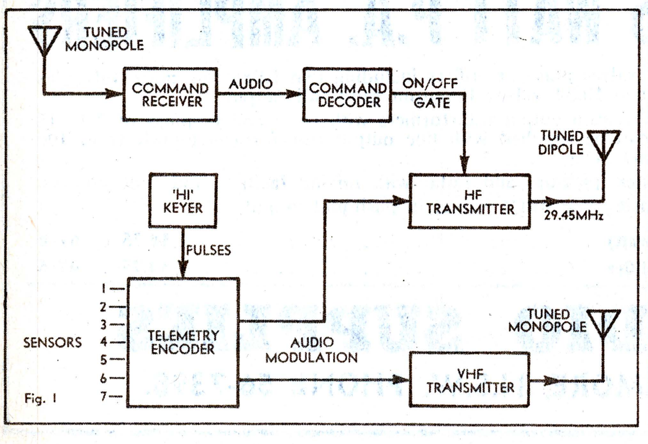


Fig. 1

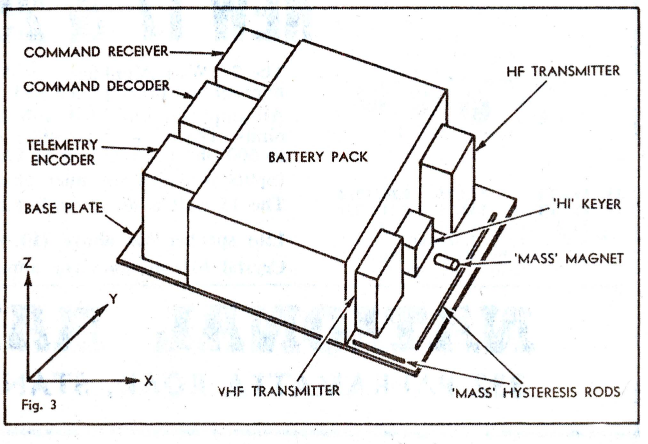
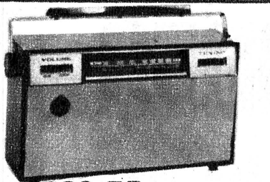


Fig. 3



NEW TRANSISTOR SIX PORTABLE KIT AT LESS THAN HALF PRICE

(DESIGNED TO SELL AT OVER £30/-/-)

Excellent fidelity is obtained in this new kit set by the use of large speaker and polished timber case with attractive gold metal front panel. By using heavy duty batteries it is economical to operate and is ideal for portable use or that second set. Complete kit of parts is supplied with full instructions. CAN BE SUPPLIED WIRED AND TESTED AT £2/10/- EXTRA. **Post and packing N.S.W., $1.25 — Interstate, $1.75.**

$23.75 (£11/17/6)

RESISTORS, CONDENSERS AND POTENTIOMETERS

We have purchased the resistor and condenser stock of manufacturers including S.T.C. and Stromberg-Carlson who have ceased the manufacture of television and radio receivers and can offer the same at less than 25 per cent of list price.

The resistors are mainly I.R.C. and Morganite in values from 200 ohm. to 5 meg. in ½, 1 and 2 watt ratings and include some wire wound resistors.

List price, $9.00 per 100. **Our price, $2.00 per 100.** Post and packing 25c extra.

The condensers are in most popular makes and include mica, ceramic, paper, and electrolytic in standard values.

List price, $11 per 100. **Our price, $2.06 per 100.** Post and packing, 35c extra.

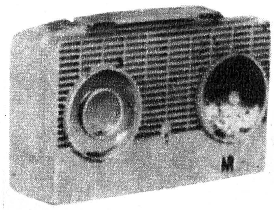
The potentiometers are all current types and include switch pots, dual concentric and T.A.B. pots.

List price, $12 per dozen. **Our price, $2.50 per dozen.** Post and packing, 25c extra.

FREE For a limited period with each lot of resistors, condensers or potentiometers purchased we will supply free: One New Type Valve Type 6U7G, 6X5GT or IT4.

SPECIAL — OFFER

Complete KIT for TRANSISTOR 6 PORTABLE $17.50



The complete kit of parts for the transistor six includes six transistors, printed circuit board, coil kit, 4in speaker, Ferguson driver and output transformers, heavy duty battery and all necessary parts to complete the set with full instructions. **Set is housed in attractive plastic case as illustrated.**

Dials available for all States. Post and Pack: extra. N.S.W., $1.00, Inter., $1.30.

NEW ENGLISH MAZDA TRANSISTORS

TYPE	EQUIVALENT		
XA101	OC45	R.F. Transistor	85c
XA102	OC44	Osc. Transistor	75c ea.
XB103	OC75	AUDIO general purpose	75c

Ducon type SFT 123 equiv, OC74 .. .. .. 75c ea.
Available in matched pairs at .. .. $1.50 pair
AUDIO OUTPUT

Post and packing on transistors 15c any quantity.

A.W.A. 23" E.H.T. transformers and 23" 110 deg. deflection yokes. New manufacturer's stock E.H.T. units $5.00. Deflection yokes $5.00. Post free

NEW VALVES AT BARGAIN PRICES

807	$1.75	3Q4	75c	6H6G	35c	6SJ7	95c	12AT7	$1.00
1A7GT	95c	3S4	$1.00	6K7G	45c	6SN7GT	95c	1L5G	95c
1C7G	30c	5V4G	$1.00	6K8G	68c	6SS7 equiv. 6SK7	85c	12A6	80c
1D8GT	95c	6B8	$1.00	6Q7G equiv, 6B6G	$1.00	6U7G	45c	12SK7	50c
1K5G	40c	6C8G	80c	6SA7GT	95c	6X5GT	75c	12SK8	80c
1K7G	49c	VR99A equiv. 6J8G	$1.50	6SH7	85c	7C7	35c	12SH7	50c
1M5G	40c							866	1.50
1P5G	25c							954	25c
1Q5G	25c							955	25c
1T4	45c							EK32	68c

Please add postage on all valves.

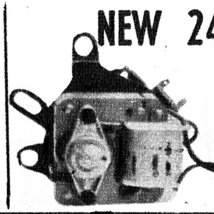
NEW 4-SPEED STEREO & MONO PLAYERS AT LESS THAN HALF PRICE

PHILIPS 4-SPEED 6V BATTERY PLAYER

MONO $9.75
STEREO $11.75

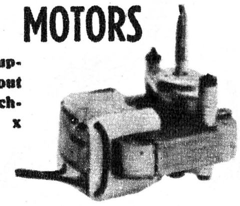
Post and Packing, N.S.W., 75c.
Post and Packing, Inter., $1.25 Extra.

NEW 240V. ELECTRIC MOTORS



3300 R.P.M. can be supplied with or without 4-speed reduction mechanism. Size 3¼" x 2¾ x 3½, including spindle.

$2.75



NEW PORTABLE RECORD PLAYER CASES TO SUIT THE ABOVE TURNTABLE

Attractive two-tone cabinet with plastic trim. Supplied with 5in x 7in speaker in felt-lined enclosure Space for amplifier and batteries or power supply.

Dimensions: 15in x 13in x 7in.

$11.50 Post and Packing: N.S.W., 90c; Interstate, $1.20.

NEW MINIATURE MOTORS

Ideal for models, toys, etc. 1½ to 3 volts. 6,000 r.p.m. 39c each or $3.50 per doz. Post 10c.

EXTENSION SPEAKERS

$8.50 **New 9 x 6 speakers in case. Post: Interstate, 55c; N.S.W. 40c.**

NEW POWER TRANSFORMERS

60mA prim.: 240v with 230v tapping Sec. 285 x 285 with 6.3v filament winding. 60mA, **$3.00.** Plus Postage: N.S.W., 35c; Interstate, 52c.

Prim.: 240v, Sec. 385 x 385 at 80mA, fil. 6.3 and 5v, **$4.50.** Post.: N.S.W., 40c; Interstate, 75c.

60mA H.T. Chokes, 75c. Post.: 20c.

T.M.K. MULTIMETERS

Before buying see our range of T.M.K. test instruments. As advertised in April issue of Electronics Australia.

TYGAN AND SARLON SPEAKER GRILLE FABRIC

List price **$8.00** per yard.
To clear at **$5.50** per yard.
Postage and packing N.S.W., 3/6. Interstate, 4/6.

NEW MIDGET POWER TRANS.

40mA prim., 240v. Sec 225 x 225 with 6.3v. Fil. Winding.

$3.25 **Postage: N.S.W., 28c; Interstate 45c.**

30mA 240v Prim. 150 x 150v. Sec. with 6.3v Fil. Winding.

$3.25 **Postage: N.S.W., 25c. Interstate 35c.**

NEW B.S.R. TAPE DECKS

These new 3-speed B.S.R. Decks are fitted with a digital counter and will take 7in spools. spools.
2 Track, $35, 4 Track, $40.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398.

LISTENING AROUND THE WORLD

Art Cushen's monthly report on long-distance short-wave, television and broadcast band reception.

More Power For Cook Island Radio

Radio Rarotonga, in the Cook Islands, is to boost its power on three frequencies to 5KW shortly, and increase its program hours to cover morning, lunch hour and evening.

The station was established 15 years ago when, at first, it used the Post and Telegraph transmitter at Rarotonga for its broadcasts to the Island territory. Mr Percy Henderson, a New Zealand schoolteacher, introduced the broadcasting service into the Cook Islands, and is now Manager of the Cook Island Broadcasting Service. The station started with a 30-minute program each week on the Post and Telegraph communications station. Later, station personnel built some transmitters, and also used second-hand equipment from the New Zealand Broadcasting Corporation. Weekends were spent in building their own studios, a large one for concerts and audience participation and two smaller ones.

The station has now ordered three 5KW transmitters to replace the present 500W unit on broadcast band 820KHz, and 250W unit on short wave 5045, 3265KHz.

The station schedule is now 10 a.m. to 1 p.m., and 6 p.m. to 10.30 p.m. local time, or 2030-2330, 0430-0900GMT, the first session being of an educational nature, other programs being in English and Cook Island Maori in equal parts. Radio New Zealand news is relayed at 0730GMT in the evening service. The station plans to operate a breakfast session soon, to be on the air 1630-1930GMT. Nine members form the staff of the station. Mr Henderson is the only non-Cook Islander on the staff.

LEBANON CHANGES

Radio Beirut in Lebanon has made further frequency adjustment in its schedule to the American continent. The service in Arabic, Spanish and Portuguese to Latin America has been heard at 2300-0100 on 17765KHz. The service to North America 0130-0400 is now on 11965KHz and provides good reception. This service is in English 0230-0300; French 0130-0200; Spanish 0330-0400; and Arabic 0200-0230, 0300-0330GMT.

The 16M band frequency is well received, but with some sideband interference from Rome, and Radio New Zealand, both on 17770. On 11965KHz the worst interference is from Moscow using 11970KHz.

LATIN AMERICAN NEWS

The afternon and late evening listening periods in the Pacific provide some interesting signals on the 90, 60 and 48 metre bands.

Mexico station XEXG, which operates on 6065KHz, has been heard at sign off at 0600GMT. The station relays XEX and uses the slogan "La Voz de Mexico." It radiates only 1KW of power and is seldom reported in this area, as normally good reception is prevented by Radio Sweden, which uses the same frequency. The station's programs are also carried by six other medium wave stations.

Peruvian stations OAX6E Radio Continental Arequipa, on 5930KHz, closes at 0500. The same sign-off time is used by OAX8V Radio Echo at Iquitos using 5010KHz. Radio America in Lima, on 6010KHz, which uses the callsign OAX4V, closes at 0600 GMT.

Radio Amazoas, using 4815KHz, was heard at good level at 1100GMT with its identification and its location as Iquitos, Peru. Radio Tropical has been tuned, on 4934KHz (opening at 1055GMT with the Peru National Anthem, followed by identification at 1100GMT and reference to the parallel frequency on 9710KHz, reports the Australian Radio DX Club bulletin.

Venezuelian station Radio Bolivar, is reported at 1030GMT on 4770KHz. The station has the callsign YVEW, and is reported to confirm reception by letter and pennant. Radio Rumbos, Caracas, with the call YVLK, operates on 4970KHz to 0630GMT on Sunday, when it signs off with the National Anthem. It also is heard opening at 1000GMT.

Ecuadorian signals on 60M provide some excellent reception. David Auld, of Greymouth, N.Z., reports HCJS1 on 4830KHz opening at 1100GMT. Radio Cenit de Portoviejo, on 4770KHz, has been heard from 1115GMT till after 1200GMT. La Voz de Rio Tarqui, on 3995KHz, is operating on Sunday, to sign off at 0700GMT, with a fair signal, and is reported to be using 500W. The callsign is HCJA5. La Voz de Esmeraldes, on 4875KHz, has been noticed at 0650GMT, when it left the air; the call, HCVE4, is assigned to this frequency. Radio Catolica is on 5060KHz, and has been received at sign-on. at 1100GMT. with identification followed by a religious broadcast.

Colombia station HJIW confirmed our reception after a year with a letter and small pennant. Verification card was also enclosed. The station operates on 6095KHz, with 1KW, and the slogan is "La Voz de Centro," and the station address is Apatado 70, Espinal, Colombia. Verification is signed by Jesus A. Yara Villareal, the director of HJIW.

Guatemalan station TGFB Radio Nacional, Tikal, has been heard at 1145GMT at fair level on 6205KHz. The station suffers side interference from the Costa Rican station Radio Reloj on 6201KHz. Radio Nacional in Guatemala City, on 6180KHz, provides good reception up to its 0600-GMT sign off.

BBC RELAY STATIONS

Schedules of the two BBC relay stations in Africa show an extension of the schedules with the recent 24-hour-a-day operation of the World Service. Francistown in Botswana, operates on 4845KHz at 0400-0445, 1630-2045GMT; also on 7295KHz at 0600-0830GMT. The program is also carried on medium wave on 602 and 926KHz.

The West African relay base is located at Monrovia, in Liberia, and carries programs on the single frequency of 9555KHz. The schedule is 0545-0915 and 1030-2015GMT. The station carries mainly the world service and has been heard in New Zealand at 0710GMT with some interference from Prague in its transmission to the Pacific area, using 9550KHz.

ROUMANIA USING 1172KHz

Radio Bucharest, Roumania is using the new 11725KHz channel for its three transmissions to North America. The new frequency is very well received at 0100-0130, 0300-0330 and 0430-0500GMT, and provides the best reception here of the station's North American service in this area. The transmission includes news commentary and features.

Bucharest is using 15250, 15225, 11940, 11810, 11725 and 9590KHz for the first two transmissions and at 0430-0500GMT adds 9570KHz to the program.

AFRICAN SIGNALS

Reception of signals from a great number of African stations during our early morning and afternoon listening periods continues to make this area one of the most listened-to parts of the world. This month several New Zealand readers — including Tony Marr, of Auckland, Theo Donnelly, of Hamilton, and Brian Clark, of Wellington — and Bob Padula, of Melbourne, supply news of the stations they are hearing from the African area.

South Africa—The home program of the South African Broadcasting Corporation, from Johannesburg, is heard with English at 0500 to 0530GMT using 6075KHz. The service seems to be on this channel for only 30 minutes. The same frequency with the Overseas Radio program is heard on 2326GMT to 0325, with an announcement that the channel is in use for test broadcasts. SABC is also being heard at 0530-GMT with the Johannesburg program on 6095KHz.

Ivory Coast — Radio Television Ivorienne, Abidjan, heard on 3242 and 4940KHz, opens with National anthem at 0600GMT. Both signals fade out at about 0700GMT.

Angola — Radio Commercial de Angola has been noted at 1800GMT, with a typical Portugese program. In Australia signals are heard at 2200GMT. CR6RZ on 4820KHz in chain with 7235KHz has been heard from 0500GMT, and reported also at 2000GMT.

Nigeria (Biafra) — Enegu in Eastern Nigeria is heard on 4855KHz, opening in English at 0500GMT in this break away part of Nigeria. Lagos on 4990KHz is good at 0550GMT with the usual English program.

Mozambique — Radio Pax, operating on 7205KHz and broadcasting from Beira, is heard in Portuguese at 0450GMT.

Mauritania — Radio Mauritania, Nouakchott, opens at 0700GMT on 4855KHz, and has news in French at 0725GMT. Previously it was on 3222KHz, now used by Radio Lome Togo.

HIGHER POWER FOR PAKISTAN

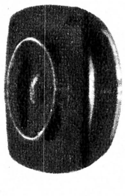
Radio Pakistan states that new 100KW SW transmitters are to be installed at the new capital, Islamabad, near Rawalapindi; also at Dacca in East Pakistan. The three transmitters are of Russian manufacture. They will aid the external broadcasting activities of Radio Pakistan.

When it became independent, Radio Pakistan had three transmitters, located at Lahore, Dacca and Karachi. The number in use has now been increased to 12 medium

foster hi-fi speakers

High Compliance tweeters

FT-502

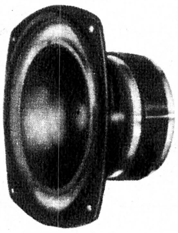


SPECIFICATIONS
Size: 50 mm (2 in.)
†Impedance: 8 or 16 Ω
Frequency Range: 2,000 ~ 20,000 c/s
Sensitivity: 100 dB
Power: 30 W max., 8 W nom.
Dimensions: 82 × 82 mm, 29 mm depth
Magnet Weight: 193 g (6.81 oz). Ceramic
Weight: 615 g (1⅜ lbs)

Price $8.04.
Plus Sales Tax $1.68.

High Compliance woofers

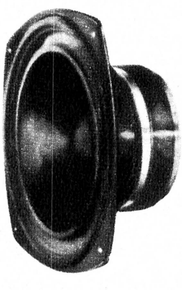
FW-162



SPECIFICATIONS
Size: 160 mm (6½ in.)
*Impedance: 8 or 16 Ω
Resonant Frequency (f_0): 40 ~ 50 c/s
Frequency Range: f_0 ~ 2,000 c/s
Sensitivity: 97 dB
Power: 30 W max., 10 W nom.
Dimensions: 166 × 166 mm
81.6 mm depth
Magnet Weight: 500 g (1⅛ lbs), Ceramic
Weight: 1,660 g (3¹¹⁄₁₆ lbs)

Price $12.00.
Plus Sales Tax $2.50.

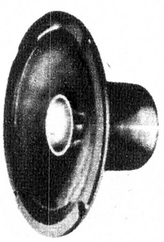
FW-202



SPECIFICATIONS
Size: 200 mm (8 in.)
*Impedance: 8 or 16 Ω
Resonant Frequency (f_0): 30 ~ 40 c/s
Frequency Range: f_0 ~ 2,000 c/s
Sensitivity: 98 dB
Power: 45 W max., 15 W nom.
Dimensions: 208 × 208 mm
90.8 mm depth
Magnet Weight: 830 g (1¹³⁄₁₆ lbs), Ceramic
Weight: 2,760 g (6¹⁄₁₆ lbs)

Prices $23.64.
Plus Sales Tax $4.93.

Double-cone speakers



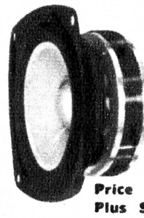
PW-65A

Size: 160 mm (6½ in.)
*Impedance: 8 Ω
Resonant Frequency (f_0): 70 ~ 100 c/s
Frequency Range: f_0 ~ 15,000 c/s
Sensitivity: 97 dB
Power: 6 W max., 5 W nom.
Dimensions: 164.9 ϕmm, 86.2 mm depth
Magnet Weight: 77.6 g (2.73 oz)
Weight: 476 g (1¹⁄₁₆ lbs)

Price $6.60.
Plus Sales Tax $1.35.

*at 400 c/s; †at 3,000 c/s

High Compliance wide range speakers



FE-103

Price $8.64.
Plus Sales Tax $1.04.

Size: 100 mm (4 in.)
*Impedance: 8 or 16 Ω
Resonant Frequency (f_0): 65 ~ 95 c/s
Frequency Range: f_0 ~ 18,000 c/s
Sensitivity: 96 dB
Power: 5 W max., 3 W nom.
Dimensions: 105 × 105 mm, 46.6 mm depth
Magnet Weight: 193 g (6.81 oz), Ceramic
Weight: 630 g (1⅜ lbs)

FE-163

Price $14.64.
Plus Sales Tax $3.05.

Size: 160 mm (6½ in.)
*Impedance: 8 or 16 Ω
Resonant Frequency (f_0): 40 ~ 60 c/s
Frequency Range: f_0 ~ 20,000 c/s
Sensitivity: 98 dB
Power: 10 W max., 5 W nom.
Dimensions: 166 × 166 mm, 73.7 mm depth
Magnet Weight: 398 g (14.04 oz), Ceramic
Weight: 1,260 g (2¾ lbs)

Coaxial speakers

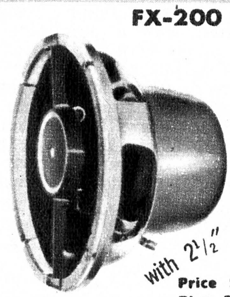
FX-201

with horn tweeter

Prices $23.88.
Plus Sales Tax $4.98.

Size: 200 mm (8 in.)
*Impedance: 16 Ω
Resonant Frequency (f_0): 45 ~ 75 c/s
Frequency Range: f_0 ~ 18,000 c/s
Sensitivity: 101 dB
Power: 10 W max., 5 W nom.
Dimensions: 206 ϕmm, 137.5 mm depth
Magnet Weight: 240 g (8.46 oz)
Weight: 2,200 g (4⅞ lbs)

FX-200 G2



with 2½" tweeter

Price $21.60.
Plus Sales Tax $4.50.

Size: 200 mm (8 in.)
*Impedance: 16 Ω
Resonant Frequency (f_0): 45 ~ 75 c/s
Frequency Range: f_0 ~ 18,000 c/s
Sensitivity: 101 dB
Power: 10 W max., 5 W nom.
Dimensions: 206 ϕmm, 140.7 mm depth
Magnet Weight: 234 g (8.21 oz)
Weight: 2,200 g (4⅞ lbs)

2-way network

LC-100
Price $6.60.
Plus Sales Tax $1.38.

Crossover Freq.: 2,500 or 3,500 c/s
Impedance: 16 Ω
Attenuation: 6 dB/oct.
Dimensions: 63.1 ϕmm, 69 mm height
Weight: 280 g (9.88 oz)

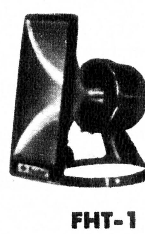
2 or 3-way network

LC-300

Crossover Freq.: 350 or 700 c/s, 2,500 or 5,000 c/s
Impedance: 8 or 16 Ω
Attenuation: 6 dB/oct.
Dimensions: 83 H × 200 W × 134 mm D
Weight: 1,430 g (3⅛ lbs)

Price $22.20.
Plus Sales Tax $4.63.

tweeter



FHT-1

FHT-1
Price $11.04.
Plus Sales Tax $2.30.

†Impedance: 16 Ω
Frequency Range: 2,500 ~ 16,000 c/s
Sensitivity: 100 dB
Power: 10 W max., 5 W nom.
Dimensions: 110 mm height, 95 mm depth
Weight: 330 g (11.75 oz)

(SOLE AGENT) ZEPHYR PRODUCTS PTY. LTD.
70 BATESFORD ROAD, CHADSTONE, VICTORIA

wave and 11 short wave transmitters. Radio Pakistan plans to use the three 100KW transmitters to extend its overseas services, and to increase the foreign language content of the programs.

CHANGES FROM CAIRO

The Egyptian Broadcasting System in Cairo is now using the 13M band for its services to South and South-East Asia. The frequency is 21615KHz. and the operating schedule is 1115-1230GMT in Indonesian, 1230-1330 in Malay, 1330-1430 in Siami. The frequency of 15360KHz has also been used by Cairo to replace 11980KHz.

It is used 1100-1200GMT in Arabic, 2230-2330 in Arabic to Latin America, 2330-0030 in Portuguese, 0030-0130 in Spanish.

English from Cairo is broadcast 0630-0700GMT on 7075, 11915KHz; 2145-2315 on 9475, 12005KHz; 0130-0300 on 9475-KHz; 2045-2215 on 15135KHz; 1300-1430 on 17690KHz; 1930-2015 on 17690KHz. Reports should be sent to Radio Cairo, Monitoring and Propagation Department, P.O. Box 1186, Cairo, Egypt.

FINLAND SCHEDULE.

The present schedule of the Finnish Broadcasting Company in Helsinki, shows that transmissions have been extended, in particular to North America. The English language service effective until September 3 is; to Europe, Friday 2100-2200GMT on 6120, 9555, 15185, 11805KHz. Saturday 1215-1315, 1600-1630, Sunday 1215-1245. Fridays 1600-1700GMT, on the same frequencies.

To North America the Helsinki transmission is operating 2300-2315GMT on 15185-KHz. This transmission is also being heard well in New Zealand with its sign-on at 2300GMT, and the channel of 1518KHz is relatively free from interference.

HCJB ADDS NEW 50KW OUTLET.

Radio HCJB in Quito, Ecuador, has added a further 50KW transmitter for its gospel programs, and has extended some of its services. The South Pacific transmission, on the air—0700-1000GMT, is now also carried for reception in Europe, and HCJF is using 15325KHz for this service. The transmission to the South Pacific is 6050, 9745, 11915KHz and this program also is beamed to Europe on the new 15325KHz outlet.

The service to the South Pacific includes the "DX Party Line" program on Wednesday at 0930GMT, which has items of DX news in the 30 minute program. The service to Europe is from 1330-2130GMT, on 17885, 15325KHz.

MONTREAL DROPS 21460

After only three weeks of operation on 21460KHz for its European and African Services, Radio Canada has reverted to the old 21595KHz channel. The frequency is in operation 1055-1212, 1345-2152GMT. Another change is that 15325KHz replaces 15365KH8, 1055-1832GMT, and then 15320KHz is used 1833 to 2152GMT sign off. The problem of finding clear frequencies for the Montreal transmission is a rapidly growing one. Some idea of the growth in demand for frequencies can be gained from the case of the BBC, which five years ago was using 60 frequencies. The present schedule of the BBC's world-wide transmissions shows over 150 frequencies in use from the 75 to the 11 metre bands.

SUNSPOT RAPID RISE

The rapid rise in the sunspot count is such that it is expected to pass the century mark by October. These conditions have resulted in some excellent HF reception by short-wave listeners. The Swiss Short-Wave Service in its monthly review of the sunspot movement shows that the increase continues to make rapid strides to the projected maximum of the 11-year cycle next year.

The review of the past and predicted counts show them to be as follows: April 65, May 84, June 87, July 91, August 94, September 98 and October 101.

FLASHES FROM EVERYWHERE

EUROPE

BELGIUM: Radio ORU Brussels carries its overseas service to Africa, Far East, North and South America. Daily transmissions are 1000-1215GMT (French, Dutch, Congolese), on 17860, 21510, 21580KHz; 1215-1230 (French, Dutch) on 11760, 21510, 11885KHz; 1600-1715GMT (Congolese) on 11715, 17860, 9740KHz; 1715-1830GMT (Congolese) 11715; 1715-1830 (French, Dutch) 17860, 9740KHz; 1830-2100GMT (French, Dutch) 15335, 9615, 9740KHz; 2315-0100GMT (French, Dutch) 11895, 9615, 9740KHz.

BULGARIA: Sofia is using the new frequency of 5920KHz. Swiss report states the program is in Esperanto at 2015-2030 and then in Italian 2030-2100GMT.

DENMARK: Copenhagen is reported to open at 0100GMT on 9520KHz, with program to North America. Danish is carried to 0145GMT, then English at 0145-0215GMT.

HUNGARY: Radio Budapest is now scheduled to operate in German 1730-1800GMT on 7100, 7220, 9833, 11910, 15160, 17890, 21685KHz. For the period 1945-2000GMT, 3995KHz is also used. English to Europe is 2130-2230GMT on 3995, 6234, 7100, 7220, 9833, 11910, 15160, 17890, 21685KHz. At 2330-2400GMT English is on 3995, 6234KHz. To North America 0030-0100, 0300-0400, 0430-0500GMT using 6234, 2720, 9833, 11910 and 15160KHz. To Australia and New Zealand the schedule is the same as to North America. The DX Program is on the air in English to the Far East on Wednesday 0800-0815GMT, and Friday at 1015-1030GMT both on 11910, 15160, 17890KHz.

VATICAN: Radio Vatican in its service to Africa now operates 1000-1030, 1035-1130, 1155-1225GMT on 17840, 21485-KHz; 1600-1705, 1710-1740, 1840-1845, 1900-1945GMT on 11705, 15135KHz. To Australia and New Zealand 2200-2220GMT on 11740, 15120KHz, and 1130-1150GMT on 11705, 17840KHz.

YUGOSLOVIA: Radio Belgrade has transmissions in English 1830-1900GMT and 2200-2215GMT on 6100KHz. Programs in Spanish are 0000-0030, 0100-0130GMT on 7200KHz. English transmission at 2200GMT which we have been hearing is also announced as being on 7200 and 9500KHz as well as on 6100KHz, which gives the best reception.

DENMARK: Copenhagen has rearranged some of its programs, but has not altered its schedule. The DX session is now carried on Wednesday instead of Tuesday, as formerly, and is in the English half hour. The transmission is at 0145GMT on 9620KHz; 0745, 1245, 1445, and 1915GMT all on 15165KHz. The service at 0745GMT is for listeners in the Pacific area.

ALBANIA: Radio Tirana in a verification card gives its English sessions as 0000-0030GMT on 7265KHz; 0630-0700GMT on 6175KHz; 2000-2030GMT on 7265 and 6025KHz; 2200-2030GMT on 7265KHz; 0230-0300GMT on 9715KHz; 0400-0430GMT on 7265, 7095KHz; 1500-1530GMT on 7265 and 7095KHz.

AFRICA

GHANA: Radio Accra in its External Service in English operates to East Africa and Asia and the Far East 1400-1430GMT on 17910KHz; 1815-1900 on 15285KHz. To North America 2000-2100 on 11850, 9760KHz. To South Africa 1500-1545 on 17910KHz. Central Africa transmissions and to Australasia, 1500-1545GMT on 21545KHz. West Africa program is 1400-2215GMT on 6130, 4980KHz. Europe service 2045-2215GMT on 9545KHz. East Africa service 1400-1430GMT using 17910KHz, 1500-1545 on 21720KHz, 1645-1730 on 15285KHz, 1815-1900 on 15285KHz. Ghana address is Radio Ghana, P.O. Box 1633, Accra, Ghana.

SOUTH AFRICA: Radio South Africa, from Johannesburg, is using new frequencies. The session in French is 1755-1856GMT on 17735, 21500KHz; English 1856-1955GMT on 15285, 17735KHz; German 2025-2125GMT on 11755, 15285KHz; Dutch 2126-2225GMT on 9760, 11900KHz, all beamed to Europe. The English program to North America 2325-0325 is on 9705, 11875KHz. A test frequency is in use, reported to be 15350KHz. The same program is also on 6075KHz.

ETHIOPIA: Radio ETLF at Addis Ababa, is using the new 31M band frequency of 9615KHz. Station opens at 0330GMT, and at 0400GMT a program is carried in English. The station is heard in North America at fair level, but in this area Latin American stations dominate the frequency.

LIBERIA: Radio ELWA, Monrovia (a gospel broadcaster) has announced that it plans to add one 50KW and two 100KW transmitters soon. The station is best received on 15155KHz with Arabic at 1930GMT, and is also heard on 4470KHz, opening at 0615GMT.

NIGER: Radio Niger, P.O. Box 361, Naimey, operates to the following schedule; Friday 0530-0630, 1130-1330, 1500-2130GMT on 7260KHz. On Sunday the schedule is 0700-1630 using 7155KHz, and 1630-2115GMT on 3260KHz. On all other days the schedule is 0530-0630 on 3260KHz; 1130-1315 on 7155KHz; 1700-2115GMT on 3260KHz.

CANARY ISLANDS: Radio Nacional de Espana relay station from Madrid has its relay base at Tenerife, and verifies correct reports with a large red-and-gold pennant. The station schedule is 15380KHz 50KW, 2345-0430GMT, with the Spanish program from Madrid. Samson Voron, Coogee, N.S.W., reports the other frequencies as 9660KHz (50KW 1400-1600GMT) and 11800KHz (50KW 0000-0300GMT). Reports should be sent to Radio Nacional de Espana, Tenerife, Canary Islands.

TUNISIA: Tunis is reported to be using 11970KHz with programs in Arabic. Best reception is at 0805GMT after Radio Liberation leaves the frequency. Tunis is also heard well on 6195KHz at 0600GMT, but suffers interference from the BBC, London, who are on this channel with the World Service.

BOTSWANA: Using 9590KHz Radio Botswana Gaberones, has been testing with a 400W transmitter at 0500-1500GMT. The signal is parallel with 5965KHz which uses 10KW, reports "Sweden Calling DXers." The tests are Wednesday and Thursday. Regular transmissions are daily, 1530-1900GMT on 971 and 4836KHz.

ASIA

MALAYSIA: Kuala Lumpur uses 9710KHz at 1100GMT. The station has Malay programs at this time on this unlisted frequency, but suffers interference from Trans World Radio to 1100GMT. Programs are the same as carried on 4790KHz.

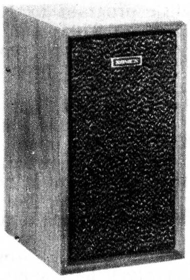
IRAN: Radio Teheran has its program in English beamed to Europe 2000-2030GMT. Frequencies are 11705 and 15105KHz. News follows the station opening announcement.

AFGHANISTAN: Kabul Radio uses the 16M band frequency 17825KHz with news in Pushto at 1130GMT. Signals at 1800GMT on 11770KHz are beamed to Europe and identification is in German and English at this time.

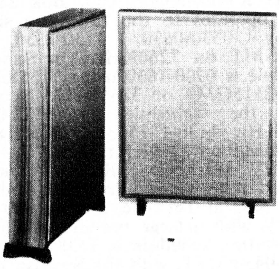
TAIWAN: Broadcasting Corporation of Chian, Taipei, has English programs 0200-0350GMT to North America and Japan on 7130, 15125, 15345, 17720, 17780, 17890KHz; and at 0200-0350 and 1030-1100GMT to Australia and New Zealand on 11825KHz. To Africa 1700-1900GMT on 9685, 9765, 11725, 11825, 15125, 17890KHz in French and English.

IMPORTED SPEAKER ENCLOSURES—HANDCRAFTED TEAK/WALNUT FINISHES!

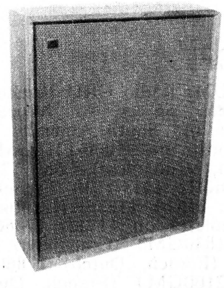
A wide range of "Sonics" multiple speaker systems is now available . . . budget conscious music lovers and tape enthusiasts wishing to upgrade their speaker systems will appreciate the excellent value of these beautifully finished oiled teak/walnut enclosures. Mail orders will be carepacked and despatched anywhere. All "Sonic" systems are 8 ohms impedance.



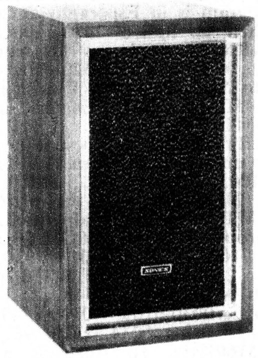
Model AS-40A. A miniature 2 speaker system 10¾" x 7" x 6" with a wide frequency response. Special floating suspension in the bass speaker **$19.50**



Model AS-61. A slimline 5 speaker system with four bass/mid range units and a tweeter. Enclosures are only 4½" deep — ideal for bookshelf installations. Will handle up to 20 watts music power. Size is 21¾" x 17¾" x 4½". Legs are detachable **$35.50**



Model AS-302. A 2 speaker system with a 12" woofer and a horn type tweeter. Frequency 20 watts music power. Size is 21⅞" x 17¾" x 11¾" **$47**



Model AS-63. The AS-63 is a special bookshelf size speaker enclosure with a 6½" floating suspension woofer and a horn type H.F. unit. Although only 14¼" x 9½" x 8¾" reproduction is excellent; used with more elaborate speaker systems a magnificent "spread" of stereophonic sound becomes available **$39.50**

Model AS-60. 18¾" x 12¾" x 15". $25. An excellent slim profile enclosure for a modest outlay.

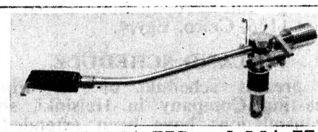
See and hear "Sonics" enclosures at Encel Stereo Centres in Sydney or Melbourne . . . they're exceptionally good value at these low Encel prices!

MICRO TONE ARMS

Very highly regarded in the United Kingdom and on the Continent, MICRO tone arms and cartridges have earned an enviable reputation for precision engineering and detailed workmanship. Performance easily justifies the use of the best available amplifiers and speaker systems. Feature for feature MICRO tone arms offer more value for every dollar; design is technically advanced and finish is impeccable.

MICRO MA-88 PROFESSIONAL 16 in. TONE ARM

Designed to provide effortless tracking with the most delicate cartridges, the MA-88 accepts S.M.E. and ORTOFON head shells as well as the MICRO head shell. The latter may be used with any standard ½ in. mounting cartridge and cartridge location is adjustable by a fore and aft movement of approx. ½ in. vertical and lateral movement is almost friction-free and is estimated at less than 20 milligrams. Height is adjustable and a bias scale and bias hook system eradicates lateral pressure of the stylus. Stylus tracking pressure is adjustable from 0-5 grams and is clearly indicated on the outrigger scale. **Encel price** **$35.50**

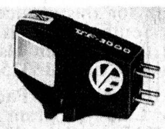


MICRO MA-77S and MA-77 TONE ARMS

Very similar in construction to the MA-88, these tone arms are 12 in. and 14 in. long respectively. A unique eccentric counter balance weight is employed with the "77" series. Connections of all MICRO arms are plug-in types to eliminate soldering, general construction is of machined solid brass and finish is satin chrome. All MICRO arms pivot on miniature ball races. Both these models incorporate the bias hook and weight system to eradicate lateral pressure. **Encel price** **$29.50**

READ THE REVIEWS!

Your April, 1966, copy of "Electronics Australia" contains a review of the MICRO MA-77 tone arm on pages 126-127. If you subscribe to "Hi-Fi News" look up your February, 1966, copy for an extensive review of the MICRO MA-77 tone arm and the M-2000/5 magnetic cartridge. This particular review extends over 4 pages!

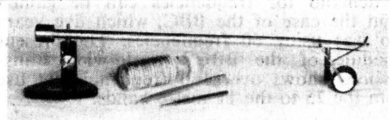


MICRO MAGNETIC CARTRIDGES OFFER UNEQUALLED VALUE

For only $19.50 you can now purchase a top quality magnetic cartridge with diamond stylus . . the Micro VF-3000. Response of this new model is 20-25,000 Hz. The Micro M 2000/5 is Encel priced at only $16.50, 's of similar electronic design and has a response of 20-22,000 Hz. Both feature a 15° vertical tracking angle. Performance is comparable with cartridges twice the Encel price . . . call in to your nearest Encel Stereo Centre and **hear** just how effective are the modestly priced Micro moving magnet cartridges. Inc. sales tax:

VF-3000 .... **$19.50**

M 2000/5 .... **$16.50**



MICRO DUST PICK-UPS

This most effective record cleaner automatically removes dust and static charges as the record is being played **$3.50**

THE PLANET MG-1504 STEREO AMPLIFIER — AN ENCEL WINNER FOR ONLY $59!

Few stereo amplifiers have excited as much interest as the Planet MG-1504. Although it's only $59, frequency response is 30-20,000 Hz. plus or minus 2 db. and power output totals 15 watts I.H.F.M. Inputs are provided for stereo pickups, tuners and tape recorders . . . and sensitivity is suitable for magnetic cartridges. Twin pre-amplifiers and power amplifiers are combined on one easily serviced chassis; separate bass and treble controls are provided for each channel. Stereo headphones plug into the socket provided.

Specifications:

Valve complement: 12AX7 x 3, 6BQ5 x 2, 6CA4 x 1.

Input sensitivities: Mag. pickup 5 mV, Tape head 5 mV, Crystal pickup 80 mV, Microphone 5 mV, Tuner 100 mV, Aux. 5 mV.

Size: 12" wide x 8" deep x 4¼" high.

ENCEL PRICE: **$59.**

Encel ELECTRONICS PTY. LTD.

Head Office: 431 Bridge Rd., Richmond, Vic. Tel. 42 3762

Sydney Store: 257 Clarence St., Sydney. Tel. 29 4563, 29 4564

Australia's Greatest Hi-Fi Centre

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SOUTH KOREA: Seoul Radio uses 15430KHz for the English transmission to North America 0300-0400GMT, and to Europe 0600-0700GMT. South East Asia service is 0800-0830GMT on 9640KHz, 1430-1500GMT on 15430KHz. The General Service in English 0500-530, 1030-1100, 2100-2130GMT is on 9640KHz.

MONGOLIA: Ulan Bator has its English service Monday, Tuesday, Thursday, Friday, from 2200GMT to 2300GMT on 9540, 11850KHz. A repeat is at 1350-1450GMT on the same days on 7340, 9540KHz, according to verification from the station.

PAKISTAN: Karachi has transmissions to Turkey 1845-1930 and to the United Kingdom in English and Urdu 1945-2030GMT. Frequencies used are 11672 and 15365KHz. Reports on the transmission to Europe are of particular value to the station, which now confirms reception with a new card, and also sends its transmission schedule to listeners.

SINGAPORE: Radio Singapore is heard with its local program on 5052KHz at 1345GMT. This is in English, but from 1400GMT the program is in Malay. Singapore is also the site of the British Forces Broadcasting Service, which uses 5010KHz. The station has been frequently heard at 1120GMT when a news bulletin in English is transmitted.

SABAH: Radio Sabah, Jesselton, is received on 4970KHz, with programs in Malay at 1230GMT. English is broadcast at 1330GMT, with the usual Radio Malaysia announcement as identification.

SOUTH KOREA: The American Forces' Korean Network, which has long operated medium wave service, is soon to be heard on short wave. This will be a 24-hours-a-day transmission and will use the frequencies of 7525 and 14425KHz. The power is to be 100W into a dipole horizontal antenna. It is presumed the short wave relay will be to aid in internal network communication.

THAILAND: The Thai Television Company, Bangkok is now broadcasting 24 hours a day on both its medium wave channel of 1500KHz, and the new short wave channel of 6010KHz. Power on the 6010KHz frequency is reported to be 10KW.

IRAQ: Radio Baghdad in its Arabic service is making use of new channels. On 11785KHz reception has been at 0530-0700, 1200-2200GMT; 15400KHz, at 0930-1200; 9555KHz at 1200-2200; and 7180KHz 1600-2230GMT. The European service, on the air 1930-2200GMT, remains unchanged on 6030 and 6095KHz English is on the air at 1930-2020GMT.

NOTES from readers should be sent to ARTHUR CUSHEN, 212 Earn Street, Invercargill, N.Z. All times are Greenwich Mean Time, add 8 hours for Perth, 10 hours for Sydney and 12 hours for Wellington time. All frequencies in kilohertz (KHz) previously shown as kilocycles (KC).

LEBANON: The Beirut station has a relay of its Home Service, using omnidirectional aerials. Program is on the air 0430-0730GMT on 5980KHz, 0925-1600GMT on 9545KHz. Both frequencies have programs in Arabic only.

CEYLON: Radio Ceylon, in Colombo, operates its Commercial Service program in English, 0130-0300GMT on 5020KHz; 0300-0330 on 6130KHz; 0730-0930 on 6130KHz; 1230-1730 on 4870KHz. Its All-Asia Service is carried 0130-0430 on 9670, 15320KHz; 1230-1645 on 9670KHz. The National Service is broadcast week days 1130-1730GMT on 5020KHz; and on Sundays 0430-0730 on 6130KHz; 1130-1730 on 5020KHz.

JORDAN: Radio Amman, on 15170KHz, transmits to South America in Spanish at 2330 with good level. The English transmission at 1700GMT is now carried on 677KHz medium wave only. The station address is Ministry of Information, Hashemite Broadcasting Service, P.O. Box 909. Amman. Jordan.

World Radio Club

The BBC began transmission last month of its new "World Radio Club" program, designed to assist listeners to understand the principles of short wave radio, to indicate new techniques being evolved which will allow better reception, and to explain how listeners can use their equipment to best advantage. Other items of general interest in the new program will include regular news features, notes for DXers, and more specialised technical talks.

Membership of the World Radio Club is open to anybody, simply by writing in. Producer John Pitman hopes that listeners will take an active part in this program, by sending in their suggestions by mail. He particularly wants to know the type of information listeners will find useful, especially the sort of information which they find hard to obtain from other sources. Listeners should send their letters and requests for membership cards to World Radio Club, BBC, Bush House, London, W.C.2.

The BBC World Radio Club is best received in the Pacific area on Saturday at 0745GMT, when it is carried on 7150, 7295, 9510, 9640, 11955, 15070 and 17810KHz. Other times are Sunday at 0245GMT on 6110, 7130, 9510, 9580, 11750, 11780, 15070, 15140 and 15260KHz; Tuesday at 2100GMT on 9410, 9580, 11820, 11860, 12095, 15070, 15260, 15400, 15435, 17790, 21550 and 21710KHz. Thursday at 1245GMT on 11750, 15070, 15420, 15435, 17705, 17790, 17885, 21470, 21550, 21660, 21710 and 25650KHz.

THAILAND: Bangkok reports that a 1000KW station to be known as the Voice of Free Asia is being completed and is expected to be in operation at the end of the year. The site is Tak Li, about 300 miles north of Bangkok. The station will broadcast in Cambodian, Chinese, English, French, Laotian, Malay and Vietnamese, reports "Sweden Calling DXers."

ISRAEL: The present schedule from Jerusalem shows that Kol Israel is on the air to Europe daily at 1545-2000GMT in various languages, including German and Yiddish at 1600 and 1830GMT respectively. The frequency 9009KHz is used with 50KW, 9625KHz with 20KW, 9725KHz with 100KW. English for South Africa is on the program at 2015-2030GMT on 9009KHz, French is at 2045GMT, and English 2115-2130GMT on 9009, 9625, 9275KHz beamed to Europe. Arabic is on the air daily, 0430-0515, 1100-1215 and 1530-2115GMT on 7189KHz with 20KW.

PHILIPPINES: A further new gospel station is to be built in the Philippines. The station will be located in Manila, and its programming will be linked with those of the Voice of the Gospel in Addis Ababa, Ethiopdia, station ETLF. The station will be erected at an early date. Its target area will be South-East Asia.

THE AMERICAS

UNITED STATES: Radio WINB Red Lion, Pennsylvania provides good reception of its programs on two frequencies which carry its gospel sessions. WINB is at present operating 1700-2000GMT on 17720KHz, and 2002-2200GMT on 11795KHz. The station has the mailing address, Radio WINB, P.O. Box 88, Red Lion, Pa., U.S.A.

GUYANA: Radio Demerera, Georgetown, using 5980KHz is now better received since the VOA vacated 6985KHz. Station opens at 0915GMT week days and on Sundays at 0942GMT with National Anthem and full identification of the network and stations. Commercial programs follow and, at 0950GMT, English news. Programs of Hindi music make up the rest of the broadcast.

CANADA: Newfoundland station CKZN at St. Johns has been heard on 6160KHz at 0900GMT. The station, with callsign Radio Canada, has an all-night transmission of music. The station break at 0900GMT includes reference to CBN St. John. The Vancouver station CKZU on 6160KHz is also heard at the same time, with its relay of CBU. Both stations have the music program of the all-night Canadian Broadcasting Corporation network.

ECUADOR: HCJB Quito, commenced recently to use a further 50KW transmitter, and is heard in the South Pacific transmission on 15325KHz. Program at 0700-1000GMT is beamed to Europe on this channel and directed to Australia and New Zealand on 6050, 9745, 11915KHz. HCJB is also using 15325KHz 0130-0300GMT in its North American service, and as well uses 15115KHz.

WINDWARD ISLAND: WIBS at Grenada operates to the Eastern Caribbean 1545-1800 on 9550KHz; 1545-2245 on 5010KHz; 2135-0215 on 3280KHz. To Jamaica, 1545-1800, 2000-2245 on 15105KHz; 2315-0215 on 11970KHz. To Ascension Island 2315-0215GMT on 11970KHz; to British Isles 2015-2130GMT on 15105KHz; 2015-2130 on 11920KHz.

The power of the station at present is 5KW, but the Windward Island Broadcasting Service plans to increase this to 100KW.

CUBA: Radio Havana, Cuba, in its English transmissions is broadcasting to Northern Europe 2010-2040GMT on 15285KHz; and to North and South America, 2050-2150GMT on 15270, 15300KHz. Further transmissions are 0100-0450GMT on 6170KHz; 0100-0600GMT on 11760KHz; 0330-0600GMT on 6135KHz; 0630-0800 GMT on 9655KHz.

HAITI: Radio Diffusion Capiose, Cap Haitian, is a new broadcaster which has started test broadcasts on 6175KHz, with 500W. Operation is 1100-1500· 2100·0300-GMT weekdays, and 1700-0300GMT Sundays. Reports should be sent to Victor C. Jaar, P.O. Box 393, Port au Prince, Haiti.

ECUADOR: HCJB is using the new frequency of 6130KHz to Europe. The station operates 0430-0630GMT in chain with 9645 and 11915KHz. The station is heard with gospel programs at this time. The frequency of 17885KHz is used 1825 to 2200GMT, also carrying programs to Europe.

NEDERLANDS ANTILLES: Trans World Radio Bonaire, is using 15245KHz for its program to Europe. Schedule is German 2030-2100 and then English 2100-2130GMT. Programs to South America on 9605KHz has Portuguese at 0910 and Spanish at 1000GMT. English to North America on 11780KHz from 0030GMT.

PARAGUAY: Radio Encarnacion, Paraguay, station ZPA5, is being heard at 0015GMT on 11945KHz in North America. This is the only station in Paraguay on the air on short wave at the moment reports Al Niblack of Indiana U.S.A. in a recent Radio Australia DX Session.

PERU: Radio Union, Lima, using 6115KHz is one of the strongest signals from this country and is heard with sign on at 1100GMT. In New Zealand the sign off at 0600GMT is also received at good level. OAX8V Radio Echo Iquitos on 5010KHz closing at 0500GMT and Radio America Lima on 6010KHz closing at 0600GMT have also been received at good level.

COSTA RICA: Radio TIQ, Radio Casino, Puerto Limon, is heard with sign off in English on 5955KHz. The station has, at times, some interference from Moscow on 5960KHz and on other occasions from Dakar which opens transmission on 5960KHz at 0600GMT. Radio Reloj, on 6205KHz, is noted at 0500GMT and also at 1200GMT when the station plays "Ave Maria" as an identification signal. TIRICA San Jose, using 9615KHz, has been heard with typical Spanish program at 0230GMT.

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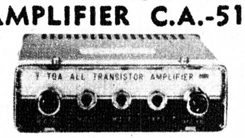

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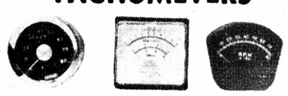

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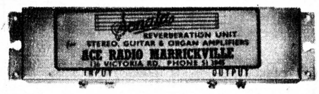

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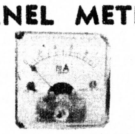

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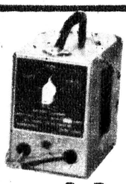

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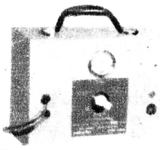

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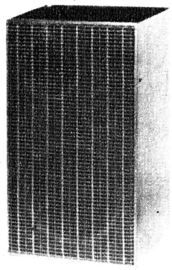

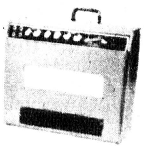

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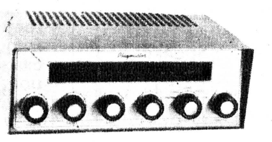

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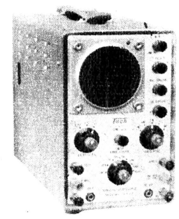

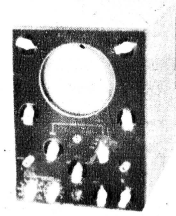

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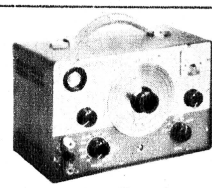


T.E.46 RESISTANCE-CAPACITANCE

Bridge and Analyser.
Capacity 20 pfd to 2,000 mfd. Resistance 2 ohm to 200 megs. Also tests power. factor, leakage, impedance. transformer ratio, insulation resistance to 200 megs. at 600V.
Indications by eye and meter.

$47.75

LEADER SWEEP & MARKER GENERATOR SMG 532

TV and F.M. 2 to 270 Megs. 5.5 Meg. Crystal for TV sound. Sweep width to 12 Megs. Model 531.

$170.00

Post., N.S.W. $1.50; Interstate, $2.50

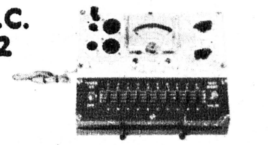
SIGNAL GENERATOR

Deluxe Model TE 20D.
Freq. range 120 KC—500 Mcs. 7 Bands. Accuracy 2 per cent. Output 8V. Provision for Xtal. Suitable for self calibration. Marker generator. Printed circuit. 240 V.A.C.

$27.50

Post., N.S.W. $75c; Interstate $1.25.

T.C. 2



VALVE TESTER

Tests all valves, diodes, rectifiers, checking filaments, shorts. Merit on direct reading. Good-bad meter. Complete with tube chart.

$26.75

Post, N.S.W. 25c; Interstate $1.25.

T.E. 50.—99—5011

Checks, Nu Vistas. Compactrons, etc.

$34.25

G.D.O. UNITS

Leader. 810. 6-Band. 2 Meg to 260 Meg Nuvistorised, 240 V.A.C. Operation. Modulated. Calibration. Accuracy 2 per cent.

$41.50

T.E. 18 Lafayette. 8 Bands. 360 K.C. to 260 Megs. 240 V.AC. operation

$39.50

Post, N.S.W., 50c; Interstate, 75c.
T.E. 15 Transistorised, 7 Band, 360 Kc to 270 Megs.

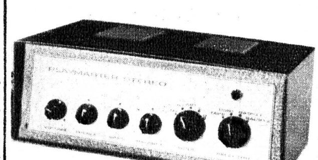
$34.75

AUDIO GENERATOR

DeLuxe Model TE—22D.
Freq. range. Sine 20 cps—200 KC. SQ. 20 cps—25KC. Output voltage. Sine 7V. SQ. TV P-P. Output impedance 1000 ohms. Acc. 5 per cent. Distortion less than 2 per cent. 4-range attenuation.
1/1, 1/10, 1/100, 1/1K. Printed circuit.
240 V.A.C.

$41.50

Post. N.S.W $1.00; Interstate $1.50



PLAYMASTER 115

The new solid state Stereo-Amplifier. April Issue.

Wired and Tested	$104.00
Kit Set	$90.00
Pre-amp to suit magnetic cartridge	$12.00

PLAYMASTER 118

Wired and tested $83.50.
Fitted with Pre-Amp to suit Magnetic Cartridge.
$95.50.

BROADCAST BAND NEWS

Continued from page 165

AUSTRALIA—The Postmaster-General, Mr Alan Hulme, has introduced legislation into Federal Parliament designed to forestall any attempts by commercial interests to establish "pirate" radio stations operating in international waters off the coast of Australia. Clause 4 of the Bill makes it an offence for any person "to establish or maintain a transmitter on a ship in waters adjacent to Australia for unauthorised broadcasting purposes." It will also be an offence for any person to assist in unauthorised broadcasts or to render services for the operation of the ship and the transmissions.

Clause 5 extends the jurisdiction of Australian courts to deal with offences arising from these activities. Mr Hulme said the Bill would be enforced as necessary in full accordance with Australia's international rights and obligations. He continued, "The Bill is much less comprehensive than the legislation which it has been found necessary to introduce, for example, in Britain in order to deal with the pirate radio problem in Europe. Nevertheless, it is expected that the Bill will be adequate to deal with the situations which are likely to arise in the Australian environment. However, the matter will be kept under close study, and if, perchance, this legislation is found to be deficient, the Government will be prepared to consider more comprehensive provisions."

Introducing the Bill, the Postmaster-General pointed out that the pirate stations operate outside the law; they pirate radio frequencies and use them without Government authority. He said:

"They represent a challenge to the lawful control of radio communications including broadcasting, and upset the good order and discipline essential to ensure a service free from interference for the thousands of lawful users of the various frequencies. These include sound broadcasts, television, aircraft and ship navigation, public communications, police, fire protection and the host of other ways in which radio communications are now utilised. The radio frequency spectrum is public property, and the public is entitled to the assurance that appropriate control is being exercised."

He pointed out that Australia was a signatory to the International Telecommunication Convention and the associated radio regulations. One regulation specifically prohibited the establishment and use of broadcast stations on ships, and another laid down that no transmitter may be established or operated without an authorisation from the Government in question.

While Australia had not till now been troubled with pirate broadcasters, some abortive attempts had been made to establish unauthorised transmitters off the coastline, and there were indications that a fresh attempt was to be made in the Gold Coast area. It was because of this that the Government had decided to bring down the present legislation.

AUSTRALIA—Three new Queensland commercial stations are expected to be on the air within the next two months. 4GG Gold Coast, 1200KHz (2KW) is scheduled to open on September 1. The new Atherton station, 4AM, on 560KHz with 2KW, is scheduled to come into operation in about two months' time. The third station, 4KZ, at Innisfail, is to use 800KHz with 2KW and is also scheduled for September 1 opening.

ANSWERS TO CORRESPONDENTS

When writing to us:—

- ***Please give you name and full postal address including the State.***
- ***Write the above information clearly or, for preference, print it in block letters. Your co-operation will facilitate delivery of replies by mail, where such are called for.***

MORE SIMPLE PROJECTS: I know many boys who buy electronics magazines looking for simple things to build but most of the projects are too complex. **(A.S. Wollongong, N.S.W.).**

The problem of trying to provide for an increasingly diverse readership is one which has faced all electronics magazines for some years and it is one which we have remarked upon a number of times. We can't promise to re-shape the journal for our younger readers only, but your request adds weight to the plea for more simpler projects.

INPUT IMPEDANCE. Would the 4-channel mixer published in the February, 1967, issue match the input impedance of my tape recorder which is 20K? The mixer has an input impedance of 5M. Must I use microphones having the same impedance? **(K.L.J., Lucindale, S.A.).**

The subject of impedance matching — when it is important and when it isn't — is one which seems to be worrying a lot of readers lately. We have earmarked it for discussion in detail when the opportunity occurs. As a general rule matching is most important when we wish to transfer the maximum amount of power from a generator, such as an amplifier output stage, to a load, such as a speaker. The correct load will enable maximum power to be developed across the load while ensuring that the generator operates under the correct conditions for minimum distortion. Almost equally important is the situation where the generator is a predominantly reactive device, such as crystal or ceramic pickup or microphone. In this case a correct load is necessary to ensure adequate output at the lower frequencies. Too low a load value and the bass response falls off seriously. Neither of the problems posed here is as serious as this. The use of a 10K source impedance (the mixer) to feed a 20K load (the tape recorder input) should present no problems at all. In fact, almost any value of load from about 10K upwards would be satisfactory. In the case of the microphone inputs, we went to a lot of trouble to produce a transistor circuit with a high enough input impedance — about 5M — to suit crystal microphones. However, as we stated on the second page of the article, microphones needing lower values of load for best performance may be easily accommodated by shunting the input circuit with a suitable value resistor, typically 47K.

TAPE BIAS CONNECTION: Could you please explain why, in some tape recorders, some of the erase signal is fed to one side of the "record" winding and the signal to be recorded to the other side? **(B.A. Brisbane, Qld).**

What you refer to as "some of the erase signal" is the high frequency bias which must be introduced into the record head simultaneously with the signal to be recorded, if the magnetic pattern on the tape is to be distortion-free. The bias voltage and audio voltage are often fed to the one side of the record head, the other side being earthed or at least bypassed to earth. This can lead to a certain amount of difficulty, in that the bias feed circuit can act as a shunt on the audio signal feed, tending to bypass the higher audio frequencies back to earth through the windings of the oscillator coil. By feeding the audio and bias signals to opposite ends of the record head coil, this trouble can be minimised. Whether or not it is convenient to arrange matters this way depends to some extent on details of the circuit and also on the accessibility of leads from the head. In some tape decks, for example, one end of the record coil is earthed adjacent to the head and it can be rather tricky to isolate the wire and provide the necessary extra lead.

FLUIDIC DEVICES: I have read a lot recently about the application of fluidic systems being used to control industrial operations. In view of the recent excellent series on electronic logic, why not a coverage of fluid logic, with particular reference to the fluidic/electronic interface? I notice that the Plessey Group appears to be very active in this field and, in America, the Corning Glass Works. **(D. J., North Melbourne, Vic.).**

Normally, non-electronic devices would not qualify for coverage in an electronics magazine but the whole thinking so parallels electronic techniques that it invites comparison and coverage. We will certainly keep you suggestion in mind — without making any promises for the immediate future.

WHAT QUALIFICATIONS? Will you advise me what education I will need for a career in electronics? **(D.H., Palmyra, W.A.).**

It will depend entirely on what level of achievement in the industry you aspire to, D.H. You will need at least the School Certificate or its equivalent since this is usually asked by employers accepting young persons as apprentices or cadets. If you are aiming at a higher level, such as a university degree, you will have to satisfy the matriculation requirements of the university concerned. We published a three-page article on the subject "Careers in Electronics" in our December, 1966, issue. If you cannot lay hands on a copy of this, the article can be obtained through our Query Service for 20c.

SUBSTITUTE TRANSISTOR: Can an OA95 diode be used instead of the OA202 used in your design for a three-band superhet receiver, described in the April, 1966, issue? If not can you suggest a suitable replacement? **(R.R., Vermont, Vic.).**

We are rather puzzled as to why you should be seeking a replacement, because the OA202 is readily available and not particularly expensive. The OA95 is not a suitable substitute in this case, since it is a germanium type with much lower reverse resistance and it would prejudice operation of the AGC system. A suitable substitute would be the BA100.

VARIOMETER COILS: Could you please tell me the number of turns for coils on a variometer? **(J.W., Timaru, New Zealand).**

The number of turns required depends on the circuit in which the variometer is to be used. As we have never published a circuit using a variometer, we cannot supply any information on the subject.

AUSTRALIAN BROADCASTING: Could you publish any information about Australian broadcasting—networks, private and Government stations, etc.—and also future development of broadcasting, especially in the television field? **(A.G.W., Auckland, N.Z.)**

We publish an annual (January) summary of Australian (and New Zealand) broadcasting stations, including television channels, with the frequency, call sign and power of each. We also publish in "News" any information which we receive about developments planned or carried out.

"ELECTRONICS Australia" Information Service

As a service to readers "ELECTRONICS Australia" is able to offer: (1) Photographs, dye-line prints and other filed material to do with constructional projects and (2) A strictly limited degree of personalised assistance by mail or by reply through the columns of the magazine. Details are set out below:

REPRINTS: For a 20c fee, we will supply circuit data, as available from our files. The amount of data available varies but in no case does it include material additional to that already published in the magazine. For complicated projects involving material extracted from more than one issue, an extra fee may be requested. As a rule, requests for circuit data will be answered more speedily if the circuits are positively identified and the request is not complicated by questions requiring the attention of technical personnel. Where articles are not on file, we can usually provide a photostat copy at 20c PER PAGE.

PHOTOGRAPHS, DYE-LINE PRINTS: Original photographs are available for most of our projects, from 50c plus 8c postage for a 6in x 8in glossy print. In addition, chassis dye-line prints are available for most projects for 50c each; these show dimensions and the positions of holes and cut-outs for metal-working but give no details of wiring.

BACK NUMBERS: A fairly good selection is available. On issues up to 6 months old there is a surcharge of 5c. On issue from seven to 12 months old the surcharge is 10c. Over 12 months, it is 20c. Package and postage is 10c extra.

REPLIES BY POST: This provision is made primarily to assist readers in matters relating directly to articles and projects published in "ELECTRONICS Australia" within the last twelve months. Note, however, that we cannot provide lengthy answers, undertake special research or modifications to basic designs. A 20c query fee must be enclosed with letters to which a postal reply is required; the inclusion of an extra fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries which fall outside the scope of "Replies by Post" may be submitted without fee and may be answered through the columns of the magazine at the discretion of the Editor. Technical queries will not be answered by telephone.

COMMERCIAL EQUIPMENT: "ELECTRONICS Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals receivers, amplifiers, etc. We are therefore not in a position to comment on proposed adaptation of such equipment, or on its general design. Prices, specifications or other assistance must be sought from the appropriate advertiser or agent.

REMITTANCES: These must be in a form negotiable in Australia. Where the charge may be in doubt, an open cheque, endorsed with a limitation, is recommended.

ADDRESS: All requests for data and information, as set out above, should be directed to The Assistant Editor, "ELECTRONICS Australia," Box 2728 G.P.O., Sydney, New South Wales. Other correspondence should be directed to The Editor.

SOUND PROJECTORS

Cinevox Prefect 16mm in good working order. 240v operated, complete with speaker and amplifier.

£57-10-0 $115.00

CIRCULAR SLIDE RULE

3¼in diameter. Will do the same work as the conventional slide rule. Instruction book included.

12/6 $1.25 each

Post 10 cents

REFLECTOR GUNSIGHT

Contains these lenses:
1 Lens 1in Focus, 1½in diam.
1 Lens 1 11/16in Focus, 1¼in diameter.
1 Air-spaced Lens, 1¼in diam.
1 Filter Lens, 1 Graticule,
1 Lampholder.

18/6 $1.85

Post: N.S.W., 30c; Interstate, 40c.

P.M.G. TYPE TELEPHONES

Standard desk type with magneto calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

£11-10-0 $23.00

(2 TELEPHONE SETS)

30c cartage to rail. Freight payable at nearest attended railway station.

AERIAL CAMERAS

F.24 Mark IV 2.9 Lens, stops 11, 8, 5.6, 4, 2.9.
With 3in x 8in F1 Dallmeyer Lenses complete with wooden case.

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(No bell). Smith's 8-day, fully jewelled. Original cost $120. Special 7in brass $25. 10½in Seth Thomas splash-proofed bakelite

£15 $30

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1½ to 3 volts DC, ideal for model boats, cars, planes, etc. Strong torque. Only

39 cents each

(Post 7c)

TELEPHONE WIRE

21 gauge copper, plastic covered. Ideal telephone or bell wire. 1,320ft coil of twin (equal ½ mile). $7.00 per coil.
Post, N.S.W. 70c; Interstate $1.20.

3000 TYPE RELAYS

P.M.G. 200 Ohm — 1,500 Ohm Coils, $1.25 each.

AWA OSCILLOSCOPE

Calibrated with delay time base. 8in, 240 vac., perfect.

£97-10-0 $195.00

AMPLIFIER

Subminiature 4-Transistor, Audio Push-Pull.

£3-10-0 $7.00 Post 50c

GOOSE NECK LAMP

NEW. IDEAL FOR DESK or WORK BENCH. Adjustable shade, strong metal lacquered base and frame. Height 18in. Complete with lead.

12/6 $1.25

Post and packing, $1.00.

HAND BEARING BOAT COMPASS

With magnifying prism illuminated. Brand new in wooden carrying case. Complete with batteries. Ideal for pin-pointing your secret fishing spot.

$35.00 (£17-10-0)

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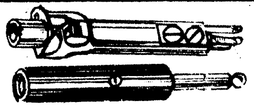


P.M.G. Phone Jack and plugs, 25c each, 45c the pair.
Post 7c.

NIFE CELLS

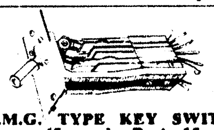
1.2 Volt fully charged, 4in x 3in x 1in 4 AH.

10/- $1.00 each

Post, N.S.W., 25c; Interstate, 35c.
1.2 volts 15 AH, 8in x 4in x 2in, $2.95.
2.4 volt 10 AH, 6in x 2½in x 2in, $2.50.
Post, N.S.W., 30c; Interstate, 40c.

PERSPEX

Slightly domed shape, 16in x 12in, $1.55. 2ft 6in x 18in tapering to 6in, $1.75. 2ft 6in x 2ft, $2.45. Domed approximately 3ft 6in x 2ft, $5.50.
50c cartage to rail. Freight payable at nearest attended railway station.



P.M.G. TYPE KEY SWITCHES. 45c each. Post, 15c.

VALVES

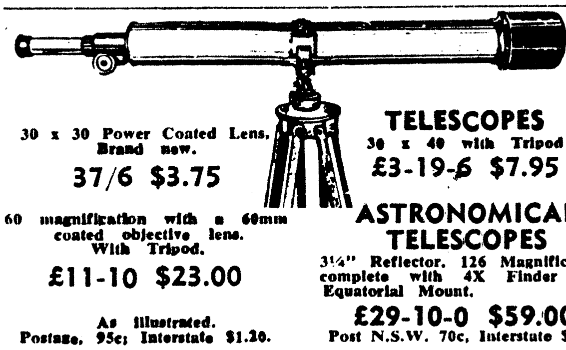
BRAND NEW

IN CARTONS.

Special discount for quantity

807	$1.75	6AG5	50c
6SN7GT	95c	12AU7	$1.00
89	$1.00	X61M	$2.20
12SA7	$1.25	CV850	$1.50
6H6	45c	1H6G	30c
41	$1.25	832	$5.00
5U4G	95c	6F13	75c
77	$1.00	6AK5	$1.50
VR150-30	$1.00	6X4	$1.00
5CPI	$3\95	6F8	75c
EF50	35c	6N7	$1.00
6U7	75c	12SK7	50c
V1103	$1.00	VR1120	50c
VH120	75c	VR118	75c
IL4	$1.00	VR65	25c
5Y3	$1.50	VT4C	75c
6C4	50c	AU5	$1.00
CV2184	$2.25	80	$1.25
2 x 2	75c	6AK8W	$1.50

PLEASE ADD POSTAGE ON ALL ARTICLES.



30 x 30 Power Coated Lens. Brand new.

37/6 $3.75

60 magnification with a 60mm coated objective lens. With Tripod.

£11-10 $23.00

As illustrated.
Postage, 95c; Interstate $1.20.

TELESCOPES

30 x 40 with Tripod

£3-19-6 $7.95

ASTRONOMICAL TELESCOPES

3¼" Reflector, 126 Magnification complete with 4X Finder and Equatorial Mount.

£29-10-0 $59.00

Post N.S.W. 70c, Interstate $1.20

HIGH STABILITY RESISTORS

I.R.C. brand new ½w., 1w, 2w, tolerances between 1 and not exceeding 5% including 100, 360, 560, 750, 15K, 22K, 27K, 100K, 180K, 220K, 560K, 820K, ohms. Usual price 40c each, 50 assorted different values for only

37/6 $3.75

Post 15 cents

GENUINE VARIACS

0-115 V.A.C. 18 Amps, $29 each, or couple 2 together for 240 V.A.C.

The two for $45

Genuine American Zenith Variacs

0-115 V.A.C. 7.5 Amps, $19.50 each or couple two together for 240 V.A.C.
The two for $36.
50c cartage to rail. Freight payable at nearest attended railway station.

522 TRANSCEIVERS

100 to 150 m/cs.

£17-10-0 $35.00

KLYSTRON MIXER/DUPLEX

units, 9375 megs, complete with crystals, $13, £6/10/ each.
Post, N.S.W., 45c; Interstate, 50c.

FRACTIONAL 240V AC MOTOR

1/25 h.p., new, with coupled 2-speed gearbox, 1425 and 300 r.p.m. Ideal for rumbler, etc.

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SWITCH BOARD FRAMES

Steel ex-P.M.G. Height 45in x 27in x 34in will make ideal test bench. £5 — $10.
Freight payable at nearest attended railway station.

C.M.A. CABLE

240 volt 3/.036 black, new and perfect. 100 yds. rolls, $3.00, 6 or more.

£1-5-0 $2.50

30c cartage to rail. Freight payable at nearest attended railway station.

MICROMETERS

Brand new Goodell-Pratt, 0 to 1in, $7.50; Slocombe, 1in-2in, $7.85; Starrett 1in-2in, $9.85.
Post, 32c.
CHOKES, 7.5H, 60mA 95c
VIBRATORS, 6 volts, 7-pin, 75c each.
UNISELECTORS, 4 BANK, $4.00
INVERTERS, 26v-115v 2Kw 400 cycle $9.50
HAND MICROPHONES, with Press-to-Talk Switch .. 95c ea.
Post, N.S.W., 25c; Interstate, 30c.
INSTRUMENT TRIPODS, sturdy wooden frame. Telescopic Extend to 4ft 6in $13.00
SELSYN MOTORS MAGSLIP Mk. II .. .. $5.25 ea.
No. 19 2-way radios, with hand set, power supply, leads, $35.00
Meggers, bridge type, complete and tested $75.00
EVERSHED and VIGNOLES, 500 volts.

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PRISMATIC. Coated Lenses.
Brand new. Complete with case.

8 x 30 .. .. $18.75
7 x 50 .. .. $22.15
10 x 50 .. .. $23.07
12 x 50 .. .. $23.95
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ELECTRONIC KIT

With solar cell can experiment with 20 different circuits, including wireless, microphone, morse code, transistor radio, audio frequency amplifier, telegraph, transmitter, intercom., signal tracer, etc. No tools, no soldering. Easy to assemble. Assembly manual included.

$19.95

Post N.S.W. 45c, Interstate 60c.

MINE DETECTORS

Ex A.M.F. No. 2 Mk. 3, with Instruction Book. Complete in wooden case. Ideal for plumbers, councils for locating buried pipes, etc. Freight payable at nearest attended railway station.

$39.00

4 DIGIT RELAY COUNTERS

50-volt D.C., suit slot car, Lap counters, etc.
$1.25. 12/6 each.
Post 13c.

RECORDING TAPES

SCOTCH BRAND.
EX-WOOMERA.
SLIGHTLY USED.
PERFECT ORDER.
Ideal for professional quality audio recording.

1200ft 7in reel ¼in $2.75. Post 12c.
600ft 5in reel ¼in $1.68. Post 12c.
200ft 3in reel ¼in 65c. Post 10c.

CRYSTAL CALIBRATOR

With 500kc crystal up to 32 m/cs. used, good condition. £4/17/6 ($9.75).

ALTEC STUDIO MICROPHONES

639B Western Electric, top grade, original cost $250, ideal Broadcast Studio, music recording, Church and play recording etc., £45, $90.

SCOOP PURCHASE

Gramo. Motors, New. Made in U.S.A. 4-speed. 240 volt A.C. 50 cyc. Only $2.75 each.
Post, N.S.W., 30c; Interstate, 40c.

240-110 VOLT 6KVA TRANSFORMERS

Encased, including switches, as new, $50. £25.

SPECIAL lucky dip valve offer. 15 new valves in cartons for only $2.00. We haven't got time to sort them, so you reap the benefit. Post, 30c.

SOLENOIDS

Plunger Type 12V 300M.A. Suit electric camera control, miniature trains, radio, etc.
$1.25. Post 10c.
200 Mill. amp., 24 volt, 1/8in push movement.
$1.25. Post, 10c.

BATTERY CHARGER

6 or 12-volt, 2½ amp, without meter, $10.50, £5/5/-.
2½ amp with meter,
4 amp with meter $14.50
$12.50, £6/5/-.
Post, N.S.W., 70c; Interstate, 95c.

TELEPHONES

Sound Powered. Can be used as Microphone and Receiver. New. With 50ft cable.
$3.85 pair.
Post, 25c; Interstate, 40c.

CARPHONES

A.W.A. or S.T.C.
Two-way radio, 75-80 megs. cycles, 12-volt operated. £22/10/ ($45) each.

EX ARMY TELESCOPES

4 x 40 Handley, $6.50.
7 x 40 Otway angle telescope, $9.85. Freight payable at nearest attended railway station.

Deitch Bros.

70 OXFORD STREET, SYDNEY

SORRY, NO C.O.D.

ANSWERS TO CORRESPONDENTS – continued

COLOUR TV COSTS: "Broadcasting" magazine for January, 1967, quotes a figure of $350,000 (U.S.) as the cost of equipping an average TV station for colour, though some stations spend nearer $1,000,000. Colour operation adds about $40,000 per year to operating costs, although some stations spend nearer $100,000. Advertisements cost more to produce and are more costly to the sponsor but there has been a rapid increase in colour penetration on all fronts. **(G.F., Toorak, Vic.)**

Thank you for the information, which we had not seen in this particular form. A lot of dollars will have to be spent before colour can be brought to Australian homes!

CAPACITOR ANALYSER: Would you consider publishing construction details for a capacitor analyser similar to a commercial one advertised in your magazine? I think this is a long-felt want **(G.F.J., Fairfield, N.S.W.)**

It is possible there is some need for this type of equipment among some of our readers, G.F.J., but, considering the cost of development of such a piece of equipment and the cost of construction, we feel that this is a little too ambitious an idea.

"PLAYMASTER" AGAIN! Upon opening your issue for April I was shocked to see yet another "Playmaster." This series seems to be getting as bad as "Dr Paul" or "Dad And Dave" on the radio and is quite out of keeping with the stream of fantastic articles on other subjects. Surely your staff should all have a Playmaster of their own by now! Also, I don't like the new term Hertz/sec. **(J. McL. Christchurch, N.Z.)**

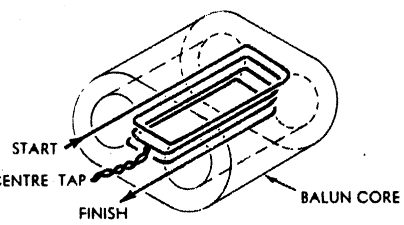
When society stops producing people with an awakening interest in high fidelity sound reproduction, and limited funds to meet that interest, we'll stop producing Playmasters! Far from being a project to fill up space, the 115 in the April issue represented up-to-the-minute techniques with silicon transistors and was the result of many requests for something along these lines. If the 115 worried you, you will have had apoplexy when you saw the 118 in the July issue; yet this, too, was the result of pressure to up-date a design that had remained a good seller for years. The saving feature is your description of other articles; you'll just have to put up with the Playmasters! Inevitably, there will be readers who tend to think the other way round. As regards your reference to Hertz/sec, we wouldn't like such expression, either. The term "Hertz" means "cycles per second" and, as such, has the merit of economy of expression. Some people like it, some people don't but our own feeling is that its adoption is inevitable. That's why we changed.

TESTING MICROPHONES: In the March issue "The Serviceman" commented on the danger of testing a microphone with an ohmmeter, due to possible damage to any mu-metal transformer. Some years ago I had occasion to return a microphone to the agents for repair, and was advised that it had been damaged by the application of an ohmmeter. Could you comment on the risk to (a) the transformer, and (b) the microphone element. **(J.C.R. Wallsend, N.S.W.)**

As you imply, there appear to be two different risks associated with tests of this kind. The more serious one, to our way of thinking, is that associated with the transformer. The nature of mu-metal is such that the passage of DC through an associated winding can cause a serious shift in its magnetic characteristics, resulting in reduced inductance in the transformer windings and attenuated bass response in the microphone system. The other risk is to the suspension system of the microphone voice coil, in the event that a continuity measurement passed enough current through the coil to cause excessive movement. The greatest risk here would arise from use of low ohms ranges on simpler types of multimeters, where a current of 100mA can flow, in conjunction with microphones with no internal transformer and direct access to the voice coil. In short, the rule would seem to be not to use the conventional ohmmeter at all where a transformer might be involved, and to use it with due regard to the current involved where the voice coil only is involved.

FREMODYNE FOUR: I am trying to build the Fremodyne Four Receiver (March, 1967) but I am in doubt as to how to wind the balun coil. Could you oblige with a rough sketch? Enclosed with parts I purchased was (I surmise) a small ferrite balun former like this (sketch enclosed). Am I correct? **(R.E., Belmont, W.A.)**

FOUR TURNS, 24 B & S ENAMELLED COPPER WIRE, CENTRE TAPPED.



The ferrite former you have depicted is the one intended for the balun. The winding details were given on page 57 of the original article, but may not have been sufficiently detailed for some of our less-experienced readers. We have therefore prepared the accompanying drawing. It may be easiest to regard the winding as consisting of four turns, with a centre tap. It is wound over the centre of the core, by passing the wire through one hole in one direction, then back through the adjacent hole in the opposite direction. This is repeated until four turns have been wound on the centre leg. It may be convenient to provide the tapping after the second turn is complete by doubling over a couple of inches of wire and twisting it to form a lead.

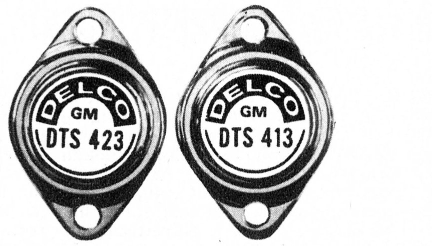
SPEED "RADAR:" Have you any intention of describing a device to warn motorists when they are under speed radar surveillance? A leaflet (copy attached) describes such a device, which can also be used on boats to indicate when they are within a radar scan, alerting them to the appropriate time to release a distress flare, or take evasive action if the radar is on a ship which may not see them. Would such a device be legal? **(P.M., Pitt Street, Sydney.)**

We have not had any direct experience with a commercial unit such as the one you mention, nor have we any plans to describe such a unit for home construction. The device would probably be classified as a receiver and would scarcely qualify for any kind of a licence. In the event of the authorities deciding to take action, they would probably be able to do so, using such legal processes as apply to the operation of unlicensed radio receivers. We do not find all the talk about marine use very convincing, nor are we impressed by the advice that one's "priceless" licence should be protected by driving soberly and carefully **and using a . . . . . .** The sober careful driver is the very one who has least cause to worry about speed checks!

STEREO EXCHANGE: I got my start in stereo with your Playmaster 101 and my first record was the Black Dyke Mills Band, to which you gave a good review—and deservedly so. Most of my records have been bought on the strength of your reviews or recommendations from friends. Is there some way you could accommodate in your columns a kind of stereo penfriend record-exchange system, so that enthusiasts could exchange information, records, etc.? **(N.W., Ferny Grove, Qld.)**

We are glad to know that you set so much store by our record reviews. The idea of a free "wanted to exchange" or "penfriends wanted" column closely parallels other recent requests for a free section to cater for tape enthusiasts and yet another to support the disbursement, exchange or acquiring of surplus components. This kind of activity can rapidly get out hand and also cuts right across the purpose of our classified advertising columns. Any reader who wants to acquire pen friends or put himself in the market for the exchange of records or tapes can do so by buying three or four lines of space in occasional issues. The cost would be modest compared with the value of the planned activity.

A COOL 400V



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RATINGS	DTS 413	DTS 423
VOLTAGE		
V_{CEO}	400 V (Max)	400 V (Max)
V_{CEO} (Sus)	325 V (Min)	325 V (Min)
V_{CE} (Sat)	0.8 (Max)	0.8 (Max)
	0.3 (Typ)	0.3 (Typ)
CURRENT		
I_C (Cont)	2.0A (Max)	3.5A (Max)
I_C (Peak)	5.0A (Max)	10.0A (Max)
I_B (Cont)	1.0A (Max)	2.0A (Max)
POWER		
	75 W (Max)	100 W (Max)
FREQUENCY RESPONSE		
f_t	6 MC (Typ)	5 MC (Typ)

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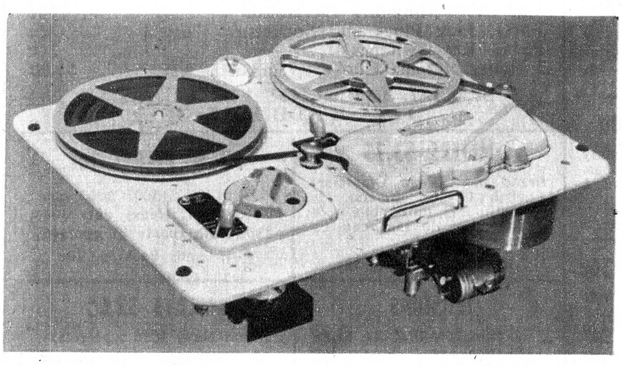

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TRAIN CONTROL SUGGESTIONS. Your recent articles on electronic train control prompts me to suggest the following projects: RF carrier control of model locomotives with a different frequency for each loco; Train detectors able to detect the presence of a train on a section of track whether the train is moving or stationary; Whistles emanating from a miniature earpiece mounted in a locomotive. **(G.D.T., Cambridge, England).**

We published an article on RF carrier control in April, 1960, using transistors in a similar circuit to that which you suggest. The idea of train detectors has been raised by a few other interested enthusiasts and is one which we will keep in mind for a possible future project. Train noises are best left to the ingenuity of the individual but are probably easier to accomplish by using track-side speakers timed to give the required noises as a train passes. There is a practical limit to the total amount of electronics — and complexity — which can reasonably be loaded aboard a model loco.

1965 COMMUNICATIONS EIGHT AND AMATEUR BAND TEN RECEIVERS

At the time of publication of these receivers, ample stocks of the Geloso tuning units were available. However, we have been advised that production of the Geloso tuning units has ceased. In the light of this information, these receivers must now be regarded as obsolete and we advise readers not to consider them as a constructional project. To the best of our knowledge, no alternative are available to the Geloso units.

"FUZZ" UNIT: As a follow-up to your latest guitar amplifiers, would you please work out the design for a suitable "fuzz" unit. **(P.T., Moorabbin, Vic.).**

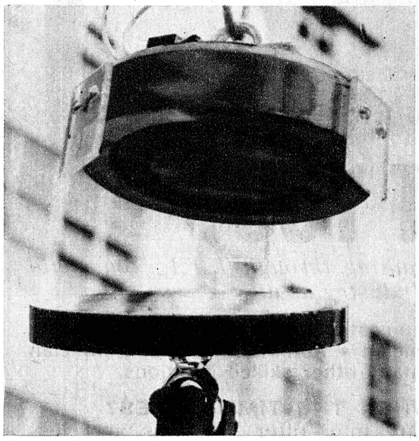
As you will have observed, we have already produced a design which should meet your request. Thanks for the letter, nevertheless.

MINIATURE ORGAN: I was intrigued by recent request in these columns for a less complex electronic organ. I am interested in such things myself but a "Wireless World" design (July 1966) would have called for 70 odd transistors and related gear, which would, I imagine, add up to $160, before even considering the keyboard and other joinery. "Electronics World" (June 1964) has a very simple unit "with full organ sound," but there are gaps in the description. Would you consider reprinting this article with the additional wiring diagrams? **(S. H., Noble Park, Vic.)**

The two articles merely bear out what we have said in the past—there is no such thing as a simple and really satisfying electronic organ. The "Electronics World" project would be simple, if built as a demonstration toy, with a single monophonic oscillator. If expanded to include a separate oscillator for each of 17 or 18 notes, plus an elementary chord bass section, it would involve a couple of dozen transistors plus all their associated components. For this, one would still not be able to play a satisfactory range of chords, because no notes would be available below middle C to build chords in that vital part of the range. Thus, by the time the "Electronics World" basics were expanded to provide some kind of musical satisfaction, one would be well on the way towards the too-expensive "Wireless World" design. The only way simplicity can be retained is on the "toy" or "monophonic" basis and one can forget about "true organ tone," etc. It may be, one note at a time—but no one ever plays an organ that way! We still have a one note organ on our list of future projects and will get around to it just as soon as we are able.

BATTERY DEMONSTRATION: Regarding the Eveready battery test, which you described in the June issue, I suspect that this demonstration is akin to the famous but now discredited "razor blade shaving emery cloth" hallucination which was really loose sand on glass! My engineering experience tells me that two flat surfaces one-third square foot in area would require a force of 735lbs to separate them at sea level. Furthermore, all engineers are aware of a fundamental physical phenomenon whereby two surfaces of one square inch area, when lapped together, require much more than the theoretical 14.7lbs to separate them. I am convinced that the (Eveready) device would lift and hold the major proportion of the weight on this basis, the magnet merely tipping the scales as it were. What weight will the device lift with the batteries off? As you may have published the article "tongue-in-cheek," I will simply comment that, even in electronics, things are not always what they seem. **(S.H., Noble Park, Vic.)**

First off, let's put the record straight. We most emphatically did not publish this article "tongue-in-cheek," nor would we have published it at all had we not satisfied ourselves that it was "fair dinkum." All the questions which you have asked of us, we had already asked of Union Carbide when they supplied the story—at our request. In fact, Union Carbide made a number of tests to satisfy themselves



that no spurious forces were involved. Both surfaces are thoroughly degreased before use and, in this condition, all attempts to "wring" the two surfaces together, or to enlist the aid of atmospheric pressure, have been unsuccessful. At one stage the two sections were clamped together under extreme pressure without any attraction being noted. The only spurious effect is some residual magnetism, amounting to about 350lbs, but this is normally destroyed by reversing the battery connection, whereupon the two sections come apart by reason of the weight of the armature. Granted, all the theories you have mentioned could be made to work if one set out to do this, but this was not the purpose of the demonstration. We understand that the unit is to be taken to Melbourne for demonstration some time in August, and anyone having doubts such as yours would be welcome to inspect it and see it in operation.

TRAIN CONTROL: I have constructed the thyristor train controller of February 1967. On my Hornby locos of various types it gives "fantastic" results re slow running and pulling at low speeds. But, on my Rivorrosi locos, the control at low speed is shocking, producing extremely jerky running. I have found that by adding resistance in series with the motor the performance improves, but the good regulation is naturally lost. **(I.D.H., Bilinga, Qld.)**

Your problem appears to be a classic case of trying to operate a particular type of loco from too high a supply voltage. As we pointed out in the original article (page 83), at very low settings of the "throttle" the thyristor may fire only once every six or eight cycles, due to minor variations in supply voltage waveform and differences in individual rectifier characteristics. Provided the loco is incapable of starting until the throttle has been advanced some little distance beyond this point, to a point where the thyristor is firing on all cycles, the operation will be quite smooth. On the other hand, a loco which is capable of starting at this setting, i.e., one which is more efficient, will move with a jerky action due to the erratic nature of the thyristor's firing action. The remedy is to reduce the input voltage to a value which prevents the loco from starting until the thyristor is firing on all cycles. Where a variety of locos are involved it should, in most cases, be possible to select a compromise value of input voltage which provides smooth low speed action for the most efficient types and adequate top speed for the least efficient types. If the difference between locos is so great that a compromise is not possible, then a selection of tappings on the transformer secondary should be provided, and used as a "coarse control." Tappings at 12V, 15V and 17V should be adequate for most situations.

SPECIAL INSERTS: I have been a regular reader of your magazine since my arrival from the U.S.A. some months ago. Why not present colour codes and safety first procedures in special inserts designed to be removed from the magazine? Such items would be of value to readers and cost could be covered by advertisers, with better than average budgets, using the reverse side. **(W.T., Yarralumla, A.C.T.).**

The whole catch is in the phrase "better than average budgets." One could be excused for gaining the impression that advertising budgets constitute a mathematical anomaly: They are all below average[Our advertising department is well awake to the potential of cards, inserts, etc., and will royally welcome any potential advertiser who has an ambition to exploit any such avenue.

TRANSISTORISED SYNCHRODYNE: What are the chances of developing a transistorised synchrodyne to feed into the Playmaster 115 amplifier? **(A.J.A., Randwick, N.S.W.)**

We have no immediate plans for developing a transistorised version of the synchrodyne, nor can we predict when or if we will attempt such a design.

TV IMAGE REVERSED: I have recently built the 1964, 23in receiver (December 1964). All is well except for the fact that the picture is reversed. Writing reads Chinese fashion from right to left and people shake hands with their left hands. I have been unable to cure the trouble so far, can you help? **(C.S. Murrumbeena, Vic.)**

One cure might be to try looking at the picture via a mirror! Seriously, all that has to be done is to transpose the two leads to the horizontal winding of the deflection yoke.

SIMPLE VHF RECEIVER: I am a newcomer to radio and electronics, but I have become very interested in VHF reception. Is it possible for you to design a very simple one with all the wiring details? I am sure there are many beginners who would be interested. **(D.R.J. Morphett Vale S.A.)**

The Fremodyne Four receiver, published in March, 1967 is reasonably simple. It would not be easy to simplify a VHF receiver much more than this, but we will keep your suggestion on file and we will look into the possibilities when we have the time and space available.

MAGNETIC PICKUP PREAMP FOR THE PLAYMASTER 118

(Continued from page 85)

board it will be seen that the board is earthed to the support bracket from both earth tags to solder lugs under the adjacent mounting screws. For the input signal cable we used a twin conductor type with a common outer shield. The input earths are connected together at the sockets and the input cable shield connects to one earth lug on the board. Do not earth the input connectors at the rear of the chassis.

The output cables from the preamp have their shields connected to the appropriate earth lugs on the board and also the earth lug on the selector switch. The earth return for the zener diode network is made to the 12AX7 spigot. Apart from the above details all earth returns for the amplifier are made as described in the July article. All earth returns for the 12AX7 preamp stage are made to a point adjacent to the 12AX7 socket.

The 9-volt supply is derived from HT1 via a zener diode network. This network and the 100K "tape-outlet" isolating resistors were mounted on an extension of the tagboard for the right channel, as shown in the accompanying sketch. Readers building the complete amplifier could obviously use a 22-tag panel for the right channel. The 33K 5W HT dropping resistor may not normally be available over the counter. Readers can "make up" a suitable resistor with value ranging from 33K to about 50K by "parallelling" higher values, e.g., two 100K2W or three 150K1W.

Moving to the other end of the same tag-board, the pair of tags mounting the 100pF feedback "phase correction" capacitor were removed and the capacitor was connected directly across the feedback resistor. In the vacated space we mounted a small aluminium (tinplate will suffice) shield which eliminates radiation from the output wiring into the pickup input sockets, which are of the unshielded type. As a further precaution, we also re-routed the output transformer secondary leads away from the pickup inputs.

PARTS LIST

1 Printed wiring board, 4in x 3in type 65/p10.
2 NPN silicon transistors, BC108, 2N3565, etc.
2 NPN silicon transistors, BC109, SE4010, etc.
2 PNP transistors, 2N3638, OC44N, etc.
6 0.1uF L.V. (low voltage) plastic.
2 6800pF L.V. plastic.
2 3900pF L.V. plastic.
2 64uF/6VW electrolytics.
1 500uF/10VW electrolytic.
1 12-volt zener diode, OAZ213-15% or similiar.

RESISTORS

(All ½-watt unless specified)

1x33K 5W (see text), 1x3.3K, 2x3.3M, 4x470K, 2x390K, 2x56K, 2x47K, 2x22K, 2x10K, 2x4.7K.

MISCELLANEOUS:—20-gauge steel preamp shield (see diagram), solder lugs, shielded cable, mounting screws, tagstrip, etc.

SPECIAL NOTE:—Where provision is to be made for magnetic pickup input, constructors should use a low radiation power transformer, i.e., one fitted with a copper shorting strap. (Ferguson PVD111FT, etc.)

CLASSIFIED ADVERTISING

Advertisements in these columns cost $0.60 per line. Each line contains the equivalent of five words each of nine letters. Minimum size of advertisements is two lines. Please note PAYMENT MUST ACCOMPANY ALL ADVERTISEMENTS EXCEPT THOSE PLACED BY ACCREDITED AGENCIES. Your advertisement for the September issue must reach our office before August 8. Address your advertisement to the Advertising Manager, ELECTRONICS Australia, Box 2728, G.P.O., Sydney.

FOR SALE

HOBBIES and model supplies. Triang railways, Rivarossi railways, Peco railways, Scalextric model motor racing, Cox slot cars, Minic Motorways, Dinky toys Matchbox models, Meccano. Write for free price lists. Please indicate interests. Free packing and postage on all orders. P.J.F. Productions, 15 Hamilton Street, Gisborne, Vic.

SELL all back issues "ELECTRONICS Aust.," in stock all times. 1939-56 copies, 30c; 57-63, 40c; 1964 to date, 50c. Post incl. T. WEIR, 55 O'Connor Street, Haberfield, Sydney. 71-2569.

RECORDING TAPE, new, boxed guaranteed. 3in x 20ft, 40c; 5in x 600ft, $1.35; 7in x 1,200ft, $1.50. Empty reels 5in, 30c; 7in, 50c. Write for free list (inc. BASF). All Mail Order goods supplied. ALMO, Bov 15, Footscrap, Vic.

RESISTOR SPECIAL. Miniature ½W, 5 p.c. tol. Top grade. Will supply 3 only resistors of each preferred value between 10 ohms and 1 meg. (57 different values), totalling 171 resistors. Full price $6.84 (4c each), inc. postage. HALLARD ELECTRONICS, Box 58, P.O., Campsie, N.S.W.

HIGH IMP. PRE-AMP. Uses 2 transistors (silicon). High gain, low noise. 9V Electronics Aust. circuit. Price $4.95 kitset form. $5.95 wired and tested. KITSETS AUST., Box 176 P.O. DEE WHY, N.S.W.

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BROADCAST RECEIVER BOOSTER KIT. This transistorised RF Amplifier will increase sensitivity, selectivity and sig./noise ratio. No alterations to receiver necessary—output of unit connects to receiver aerial socket. Power gain 25dB. Reception of distant stations made clear. Stops fade. Full price 35/- ($3.50). Prompt service. HALLARD ELECTRONICS, Box 58, P.O. Campsie, N.S.W.

SIGNAL INJECTOR KIT, 5000cps—2MC. Very handy instrument indeed. 2 transistors. Small size 29/6 ($2.95). 35/ wired and tested. Post free. Prompt service. KITSETS AUST., Box 176, P.O. DEE WHY, N.S.W.

SHORTWAVE RECEIVER BOOSTER KIT. Enables distant stations to be received clearly. Stops fade. Power gain 28dB. Freq. 3.2-12MC. Size 2in long, 1½in wide and 1¼in high. Output connected to receiver aerial socket. Price 45/ ($4.50). Wired and tested $5.50. KITSETS AUST., Box 176 P.O. DEE WHY, N.S.W.

MODEL Compound marine engine (1¼in x 1¾in x 1¼in). New design. Bolton, 72 King Street, Sydney. 2000. Catalogue. 80c.

MICROPHONE stands. Grey baked enamel TR1 base with chrome tube extending to 6ft. $9.75. Trade supplied. Rambler Recording Co., 39 Swanston St., Mentone, Vic. Tel. 93-4545. A.H., 787-2465.

CUSTOM Built Transformers—Power, Audio, etc. Single or quantity production. Amplifiers, P.A. systems, battery chargers. Rectifiers, electric motors, transistor radios General engineering, fitting and turning, sheet metal work, etc. Parkinson Transformers, P.O. Box 523, South Brisbane. Phone Beenleigh 33. Qld.

ELECT. Aust. 39/67. Radio/TV books, cheap, write list. 1 Soudan St., Coburg, Vic.

BOX of radio parts, inc, keyswitches, pots, coils, spkrs., radio chassis, etc., £5. 1200ft tapes 10/. TR1936 no xtals genemotor, £10. Add freight. Foot, 65 Wave Ave., Mt. Waverley, Vic.

SELL Recording studio, going concern, Brisbane central city position. Initial inquiries, Box 141 P.O., Broadway, Brisbane, Qld.

TRANSFORMERS wound. Output or mains, and specials to order. Paris Radio Electronics, 7A Burton St., Darlinghurst, N.S.W. 31-3273.

R. TV & H., Electronics, most copies from 56 to date. Best offer. Melb., 56-3315, Vic.

FET-VOM. Field effect transistor volt-megohmmeter, completely wired, all range switches, etc., less 0.1. Ma meter, less cabinet. TV field service tested many months. $25.60. D. Haltermann, 4 Mt. Albert Rd., Geelong, Vic.

BC611 Walkie Talkie. Pair with xtals, valves, untested. $40. O.N.O., 23 Lambert St., Frankston. Ph. 783-5200, Vic.

2 FIELD Telephones, type "F" MK. Good working condition. $24. 8 Edward St., Kew., Vic. Ph. 80-1644.

MAY, 1966, 3in CRO, $50, partly complete. July, 1963, 3in CRO, $25. 10 Clifton Parade, Warrawee. 48-4858. N.S.W.

TV Picture Tubes—14in to 24in. Trade only. New $12, rebuilt, 2-year warranty $12, 1-year $11. Bonded 23in new $26, rebuilt $24, seconds $16. All prices plus freight and dud or deposit on dud, 14in-21in 70 $5.90, $8. 21in 110 $8, 23in $10, 23in bonded dud deposit $9. Extra charge for scratches $2. Extra if air in dud $3 (bonded $6). Available at slightly higher price at 1120 Oxley Road, Oxley Brisbane. We buy duds. Sure Brite. 22a Victoria St., Lewisham, N.S.W. Phone 56-6363.

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REPAIRS to receivers, transmitters, construction, testing.: TV alignments. Xtal conv., specialised electronic equip. Eccleston Electronics 146a Cotham Road, Kew, Vic. 80-3777.

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NEW S.T.C. Carphone converted to 146. All plugs, Xtals and Manual avail. Good price for good job. 2ZMU. 78 Aberdare Rd., Cessnock, N.S.W.

FREMODYNE Rec., or tuner, made to Electronics Aust. spec. No Jap parts to be used. As demo., model. Price and particulars, J. Palmer, Box 77, P.O. Annandale, N.S.W.

TV Signal generator or B&K analyst. Details, T. Randall, Box 32, Bourke, N.S.W.

AR8 Receiver in working order. Price and particulars to K. Doessel, Railway Parade, St. Lawrence, Qld.

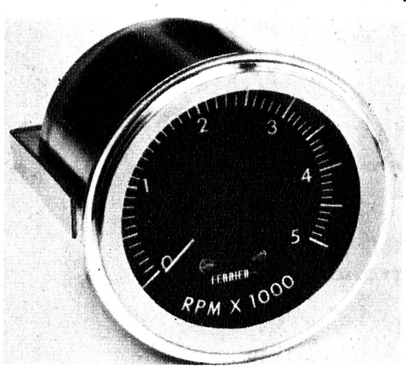
WANTED

BYER or Rola 66 or 77 recorder. Must be in good cond. Rambler Recording Co., 39 Swanston St., Mentone, Vic.787-2465.

78 rev. records. Theatre pipe organ music. Robertson, 17 Carinya Rd., Mt. Colah, N.S.W. 47-3807.

PAIR used 12in co-axial speakers. Goodman or Wharfedale standard. Sydney. 88-2931. N.S.W.

TR1196; Fremodyne; RA1B/J receivers. 78 Battye Avenue, Kogarah, N.S.W. 58-4550.



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ELECTRONICS Australia Classified Columns

To the Advertising Manager,
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ADVERTISING INDEX

At $59.00 THE LABCRAFT SRT 643

is the ONLY turntable anywhere near this price that gives you these OUTSTANDING ADVANTAGES :-

MODEL 643 STEREO RECORD PLAYER

SCANDINAVIAN RADIO TELEVISION Co. SRT COPENHAGEN DENMARK

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Douglas B.J.Trading.	197 Russell St.	Melb.
Douglas Radio.	199 Darling Rd.	E.Malv.
E.& S.Trading Co.P/L.	234 High St.	Ashburton.
Electronic Developments.	232 Flinders Lane.	Melb.
Hannams(Sales) P/L.	8 Station St.	Mitcham
Herbert Smalls Camera	193 Princes H'way	Morwell
Macey & Rose	465 Centre Rd.	Bentleigh.
Magrath J.H. & Co.	208 Lit.Lonsdale St.	Melb.
Malvern Star Stores	161 Sturt St.	S.Melb.
Master Electrics P/L.	547 Elizabeth St.	Melb.
Myer (Melbourne) Ltd.	Lonsdale St.	Melb.
McPhersons Hi-Fi Centre	205 Dorset Rd.	Boronia.
Radio Parts P/L.	562 Spencer St.	Melb.
S.T.A.Electronics	731 Centre Rd.	E.Bentl.
South City Electrics	280 Clarendon St.	S.Melb.
Suttons Pty.Ltd.	105 Elizabeth St.	Melb.
Thomas' P/L.	161 Exhibition St.	Melb.
Warburton Franki P/L.	220 Park St.	S.Melb.

South Australia

Audiorama Sales	15 Brigalow Ave.	Blackwood
Elac Automation	224 Hutt St.	Adelaide
MACK'S ELECTRONICS	199 Rundle St.	Adelaide
Spencer Gulf Radio & TV	46 Alexander Street	Port Pirie
Truscott Electronics	62 Hindmarsh Sq.	Adelaide

New South Wales

Arrow Electronics P/L.	422 Kent St.	Sydney
Bardsley Imp.Tdg.Co.	166D Glebe Rd.	Glebe
Broadway Electronics P/L	206 Broadway	Sydney
Convoy International P/L	449 Kent St.	Sydney
Dickens &Carey(Bathurst)	76 Keppel St.	Bathurst
Lawrence & Hansen Ltd.	188 Parry St.	N'cstle W
Radio Despatch Service	869 George St.	Sydney
United Radio Dist.	Shop 32,Ash St.	Sydney
Victor,A & Co.	196 Elizabeth St.	Sydney
Wilson, H.Ben	166 Glebe Road	Glebe

A.C.T.

Hi-Fi Laboratories	39 Kitchener St.	Hughes
Australian Physical Labs	6 Caladenia St.	O'Connor
J.B.Young Ltd.	Kingston	Canberra

Western Australia

Alberts T.V.& Hi-Fi	832a Hay St.	Perth
Atkins (W.A.)Ltd.	894 Hay St.	Perth
Carlyle & Co.P/L.	1 Milligan St.	Perth
General Accessories	36 Milligan St.	Perth
Hill, Athol M.	613 Wellington St.	Perth

Queensland

BRISBANE AGENCIES	76 Wickham St.	Fortitude Vl.
Chandlers Pty.Ltd.	Cr.Albert & Charlotte	Brisbane
Croker.Jas & Sons	Victoria St.	Mackay
Harrold A.E.P/L.	123 Charlotte St.	Brisbane
Pearce C.A. & Co.	33 Bowen St.	Brisbane
Trackson Bros. P/L.	157 Elizabeth St.	Brisbane
Ward.Norm Electronics	37 Love Lane	Mund'burra Towns.

Tasmania

Genders, W. & G.P/L.	53 Cameron St.	Launceston
Homecrafts P/L.	199 Collins St.	Hobart
Homecrafts-Tasmania	120 Charles St.	Launceston
Homecrafts-Tasmania	53 Wilson St.	Burnie

Northern Territory

Pfitzners Music House	2 Darwin Arcade, Smith Street	Darwin

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If you would prefer to mount your own arm, or a famous B & O or All-Balance arm, choose from Labcraft 605, 605L or 655 model turntables!

SOLE AUSTRALIAN AGENTS

G.R.D INSTRUMENTS PTY. LTD.

6 RAILWAY WALK, CAMBERWELL, VICTORIA. TELEPHONE 82 1256

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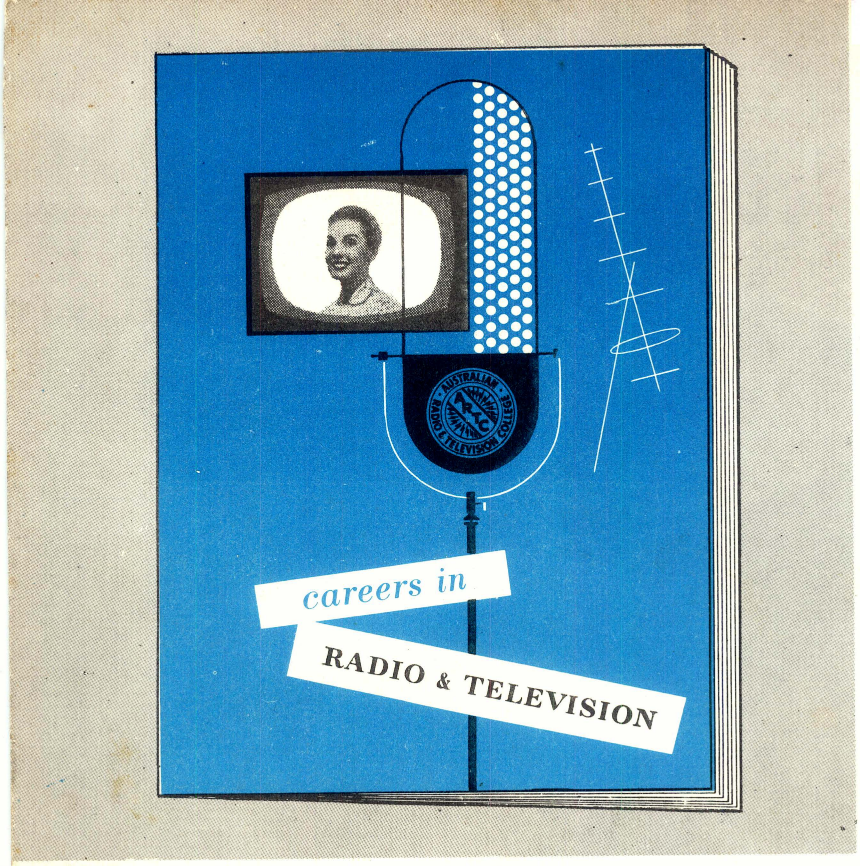

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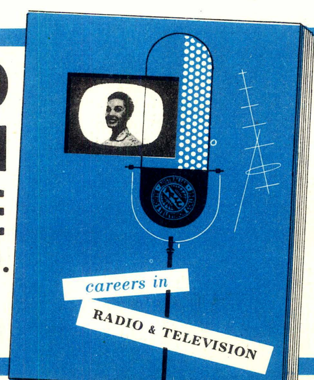

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